MICRO COMPUTER PRINTOUT

A PLAIN MAN'S GUIDE TO PERSONAL COMPUTING

OCTOBER 1982 95p

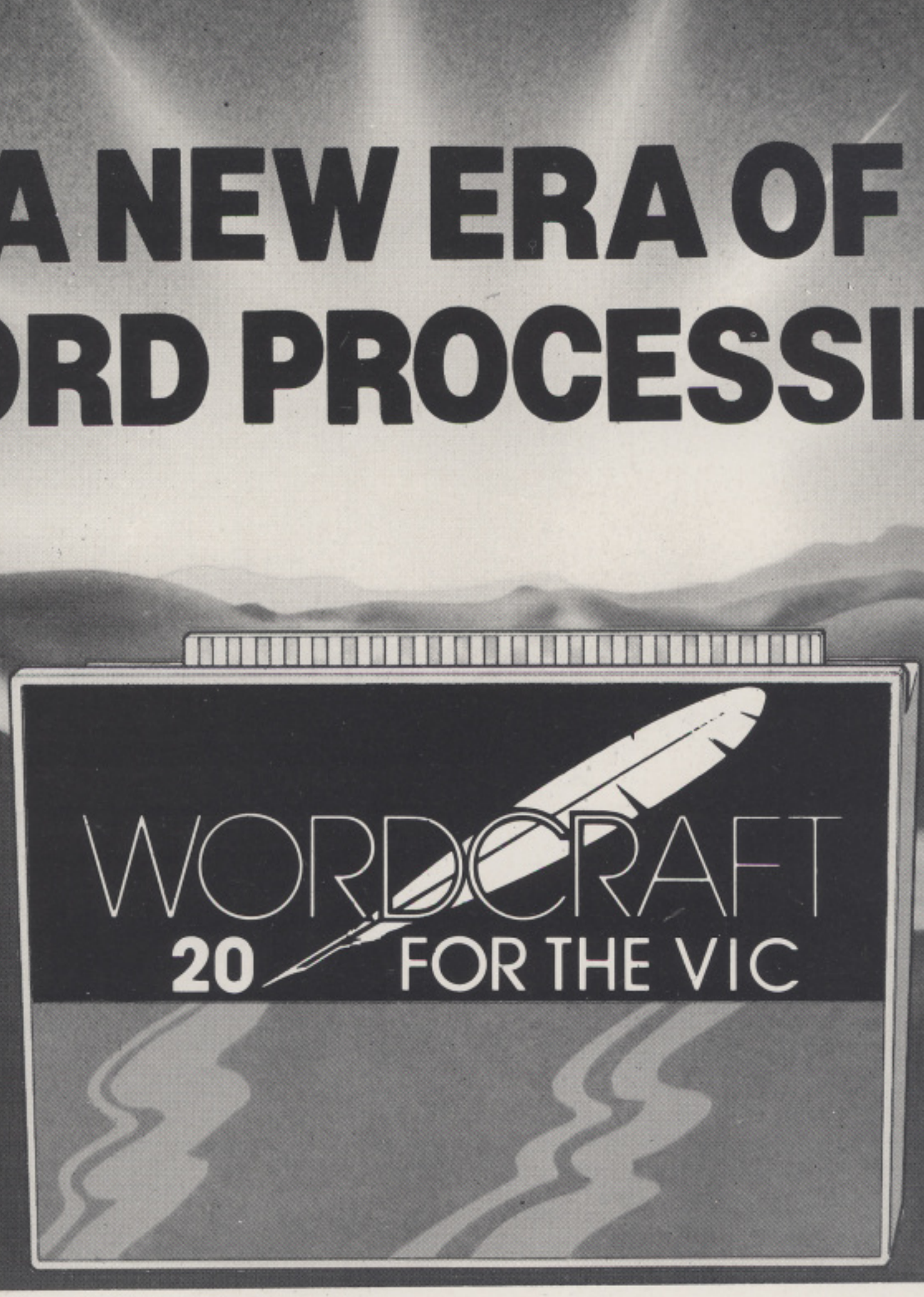
HOW TO WIN AT SPACE INVADERS

INSTALLING A MICRO...

How to avoid the disasters!!!

WIN A commodore 64

A NEW ERA OF WORD PROCESSING



The introduction of Wordcraft 20 for the VIC brings the benefits and advantages of full scale word processing directly to the general public.
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Wordcraft 20 comes on a cartridge ready to plug into the back of the VIC. Included in the cartridge is an extra 8K of RAM that is also available for use with other programs – so not only do you get a word processor but you also get a memory expansion thrown in. The system also comes with complete documentation catering both for the inexperienced user and for those already familiar with Wordcraft 80.
Just look at these features:
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Wordcraft 20. The package that the VIC user has been waiting for. A word processor of proven quality at a low price.
For the first time ever, every home can have one.

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Wordcraft 20: £125.00 inc. VAT and p&p. Available from all VIC dealers or direct from Audiogenic Ltd. PO Box 88, Reading, Berks. Tel: 0724 586334.
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P.T.O. for more info!

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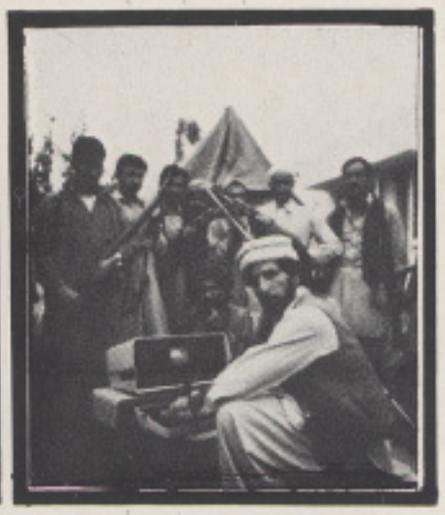

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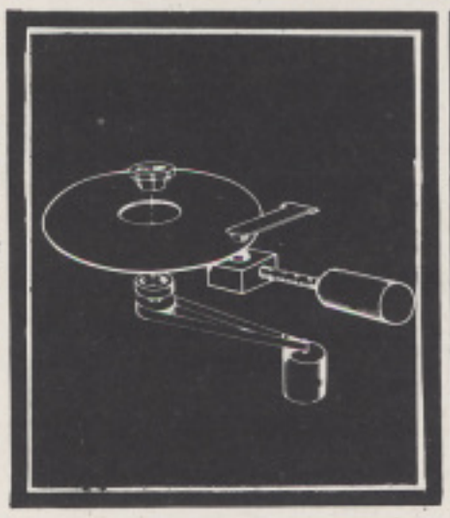

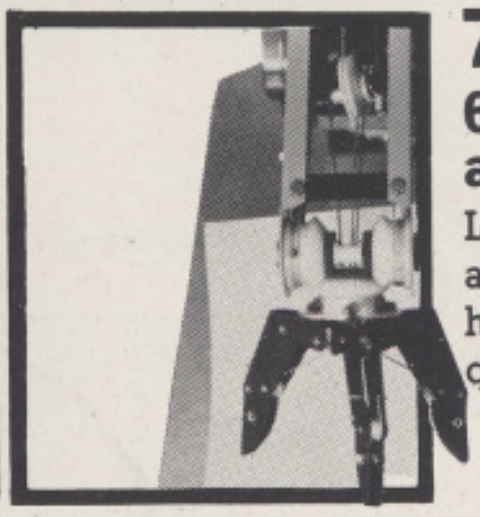

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FRONTLINE

The invention of the microcomputer was a major breakthrough in the application of technology. Instead of being available only to a select few in the Data Processing Department, computer processing power is now available on the desktop – where business decisions are made; and in the home – where people can learn and play at their own pace.

However, because the majority of microcomputer users and potential users now have little or no formal computer training, new forms of communication are needed to teach people how to choose and buy a computer – and then how to use it. *MicroComputer Printout* is a new form of communication.

Put in a nutshell: if you are still *learning* about the application of microcomputers, then we can help.

If you are a complete beginner then you'll want a thorough grounding in what microcomputers are all about, written in plain English and with no assumptions of prior knowledge. *'What makes up a computer?'* is the second of our beginners' explanations (last month we dared to tackle the question 'What is a computer, anyway?')

If you are buying a business system then the cover story *(Installing a Micro)* is for you. Too many installations have resulted in disaster because the company hasn't considered the many side effects. So this month's *Business Briefing* contains an invaluable checklist which should iron out a good many potential problems.

One thing you'll notice about *MicroComputer Printout* (apart from our light-hearted style and contempt for all computer boffins) is that we frequently lump home and business applications together. Though we are careful to point out the differences between the two kinds of hardware, we believe that many of the principles you need to learn are common to both. Indeed many businessmen are buying home computers with a view to learning about their application in business.

So whatever your disposition, don't miss our two applications features this month – *Osborne in Afghanistan* and *Travel Agents* – for interesting case studies of how the microcomputer can help professionals at work.

And finally, even if business is your sole aim, we dare you not to read this month's centrefold: *How to Win at Space Invaders*. There can't be one of us who wouldn't like to teach those little perishers a lesson....

Richard Pawson – Editor

...AND NEXT MONTH

Yes, we know you've only just got this issue, but we can't resist showing off about next month's contents already.

We're attempting something quite unique in explaining what Database is to the newcomer. No, we won't be supplying cut-and-dried definitions in yet more incomprehensible jargon. Rather, we have tried and tested eight different programs which might be called databases and asked: who could use it, and what would it do for their business?

For beginners, there is a pull-out guide which explains which type of microcomputer you should be looking at, while for those who've already bought their business micro, we tell you how to run it smoothly.

And just to prove that we're not all work and no play, we shall be taking a sideways look at *Computer People* – the different types, how to recognise them, and what to do if you meet one!

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AND YOU WOULD LIKE...

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THE ABILITY TO AUTOMATE YOUR
BUSINESS ROUTINES THE WAY
YOU WANT

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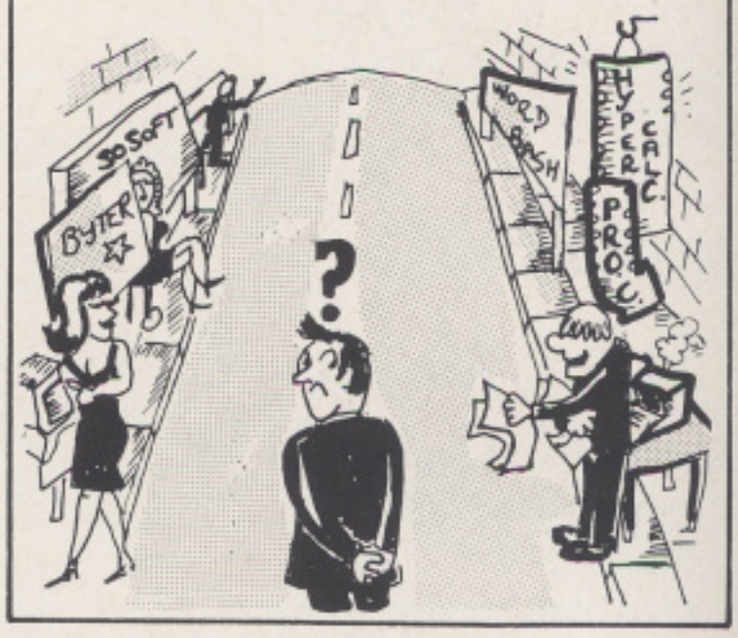
WITHOUT THE
HIGH COST

WITHOUT BEING A
COMPUTER EXPERT

IN WHAT CAN ONLY BE DESCRIBED
AS A CONFUSING MARKET



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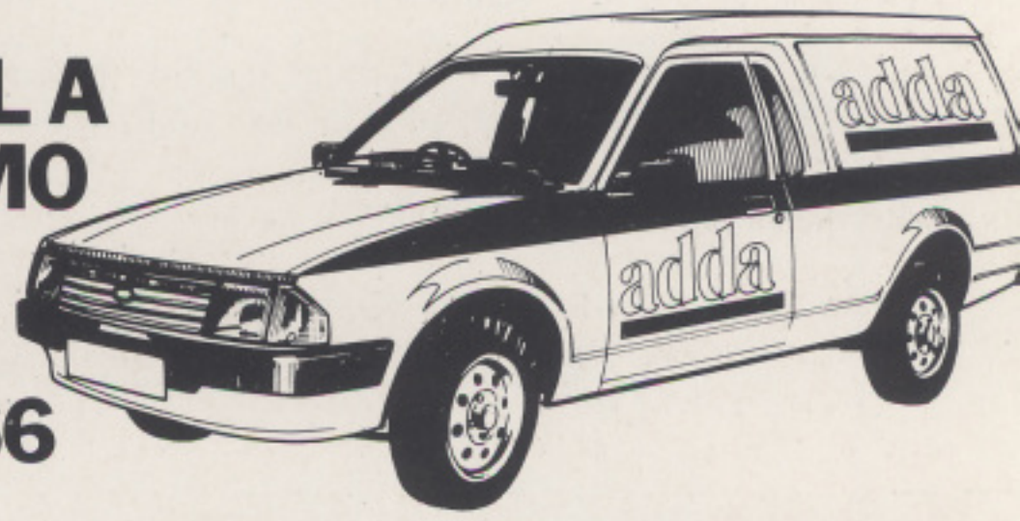

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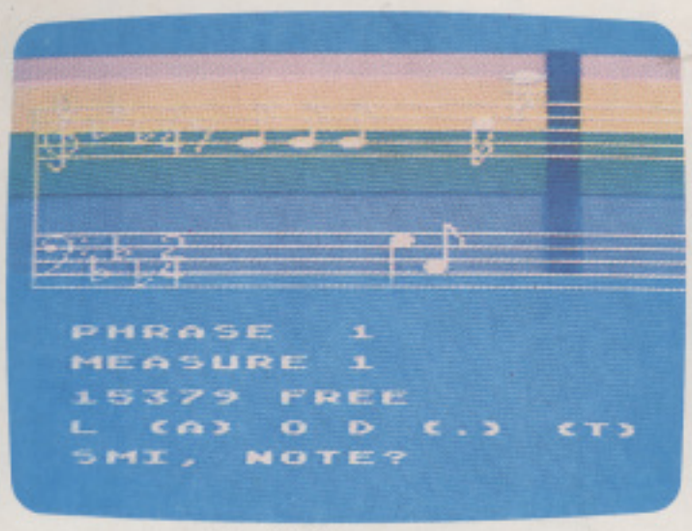
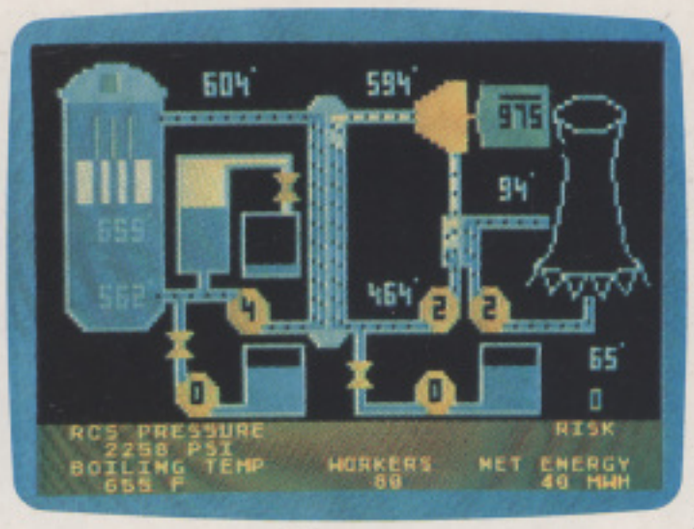
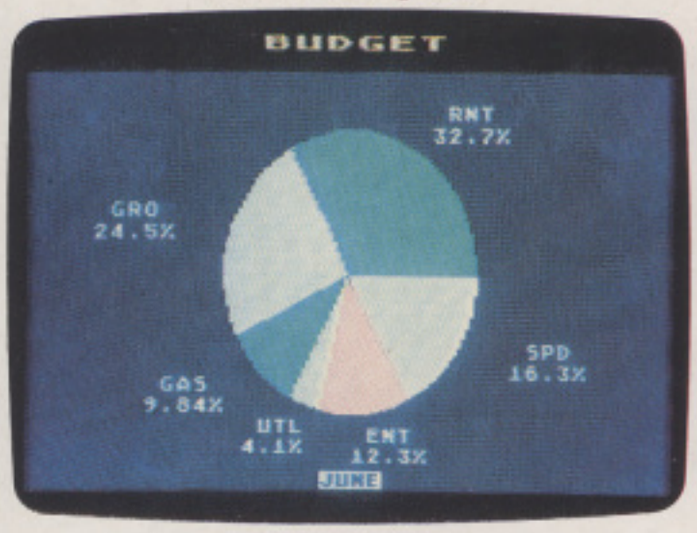


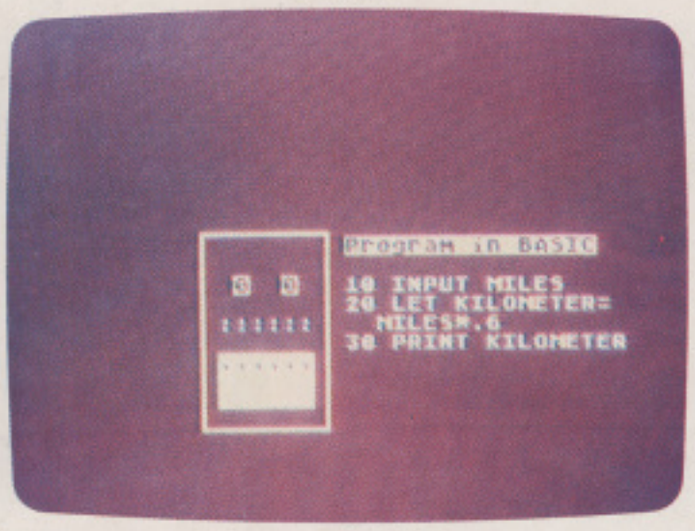
Music Composer



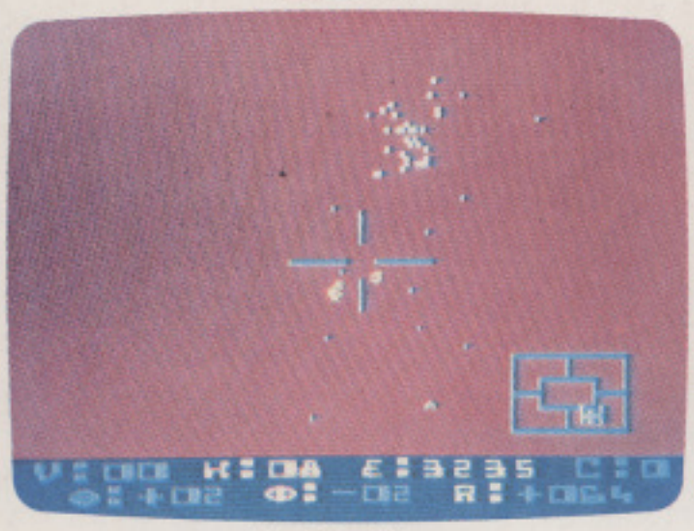
Scram



Graph-it



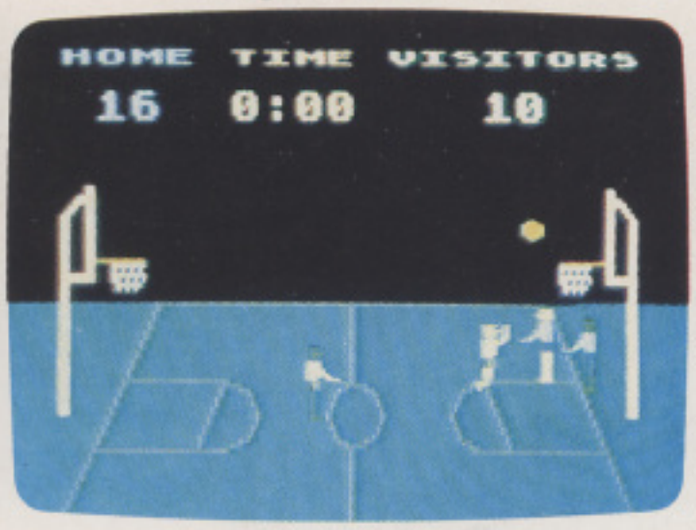
Intro to BASIC 1



Star Raiders

European Countries

Missile Command



Basketball

3.7 million reasons why the Atari Home Computer is something to see. The display screen used with our computers is composed of 192 horizontal lines, each containing 320 dots. Delivering colour and luminosity instructions to each dot for a second requires 3.7 million cycles...a lot of work for the normal 6502 processor.

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That's a quality you just don't find in ordinary home computers. And it's one of the reasons some computer experts say that Atari computers are so far ahead of their time.

There's more...which is what you'd expect from Atari Language. The Atari Home Computer uses several programming languages to give the user maximum control of its extraordinary capabilities. PILOT, Microsoft BASIC and Atari BASIC are understood and spoken by the Atari computer. You'll also find our Assembler Editor cartridge indispensable for machine language programming.

Sound. An Atari computer has four sound generators, or voices, activated by a separate microchip. This leaves the principal microprocessor chips free to perform other tasks. And you can take full advantage of this capability which is designed for easy programming.

Change. Atari Home Computers have been designed to make change and expansion easy. The Atari computer has a modular operating system that can be easily replaced as new technology develops. If you need it, memory expansion requires no more than inserting additional RAM modules.* And the Atari ROM cartridge system also makes it easy to change languages. In short, your Atari computer won't become obsolete by future developments...because it already incorporates the future.

Sharing. To learn more about the amazing capabilities of Atari Home Computers, either visit your local dealer or fill in the coupon below.

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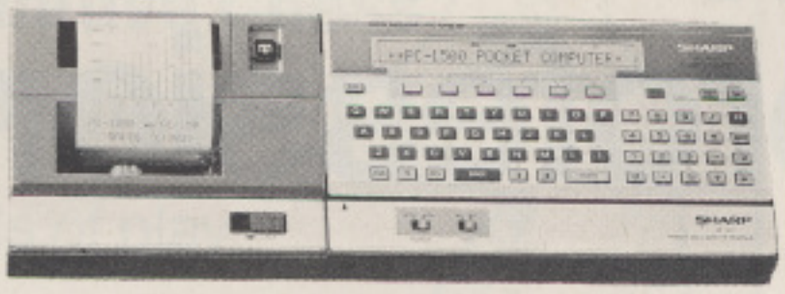

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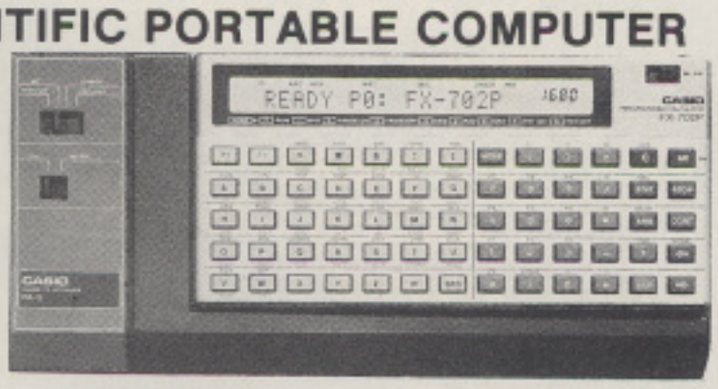

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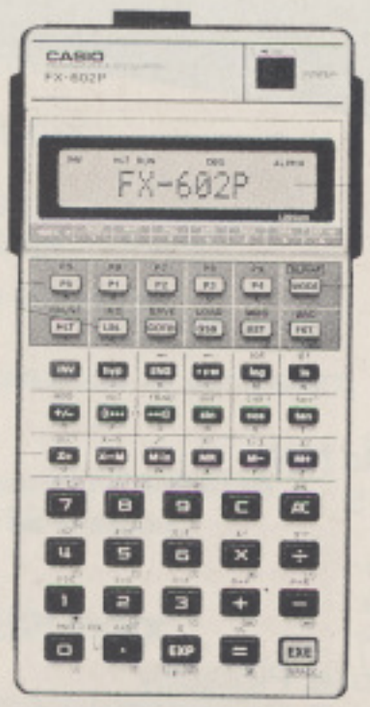

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IT'S MORE FUN LEARNING WITH VIC -at Home or School

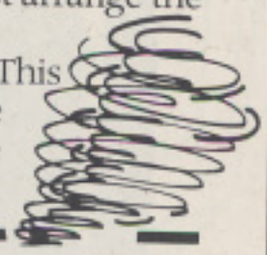
If you are over 3 years old, and still young enough to hit the keys, then these new VIC programs are for you.

From top software publishers ASK, they let you learn—and laugh about it too.

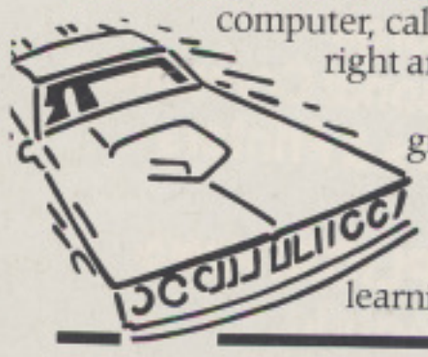
Fabulous graphics. Demanding ideas that make learning lots more fun.

All on cassette at £8.95 inc. VAT.

TWISTER. Designed to improve concentration and logic. Rearrange a geometric puzzle—a bit Rubik cube-like—so that no row or column contains a repeated colour. There can be from 3-10 columns and if you cannot get out of it, Twister will do it for you. For really clever users you can go into the Super-Twister mode where you must arrange the squares so that no diagonal, as well as row or column, contains the same coloured square. This is so difficult that the computer does not give you the answer! Supposedly designed for age 8 upwards.



NUMBER CHASER. Designed to improve estimating and multiplication skills for 5-12 year olds. A car race where you move against the computer according to your skill at estimating the given sum. We forget that in the age of the calculator estimating is important to see if your computer, calculator etc has come up with the right answer.

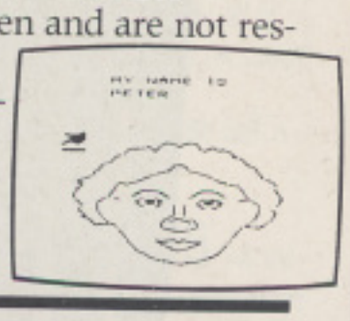


Number Chaser has superb graphics and sound—you would not want more than a few of these in a classroom at any one time since the level of excitement, as well as learning, is very high.

FACEMAKER. This is designed to improve spelling, to expand vocabulary and also sharpen observational skills. Designed for 5-12 year olds this is an interactive program where you draw people's faces.

Superb graphics that—like most of these ASK programs—fill the monitor or TV screen and are not restricted to the normal VIC format.

A beautifully crafted piece of software that will find many applications in school and at home. It will also be of special benefit to people teaching children who are slow to learn to read.



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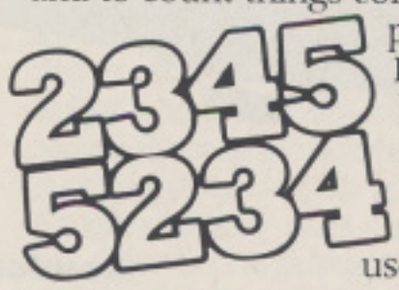

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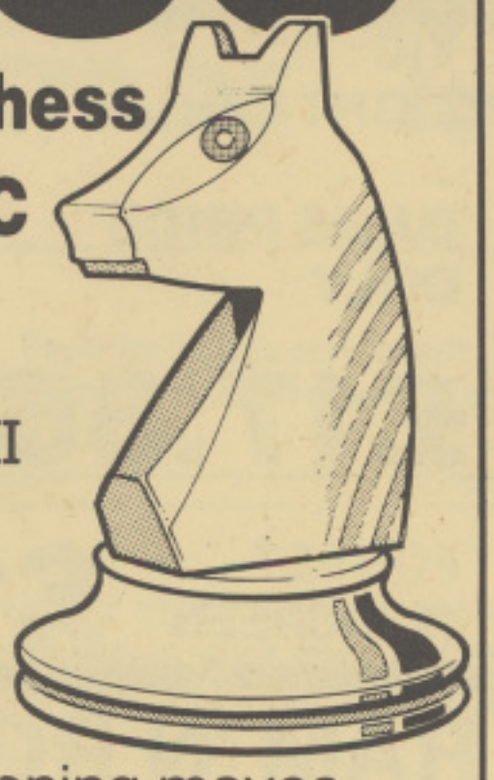

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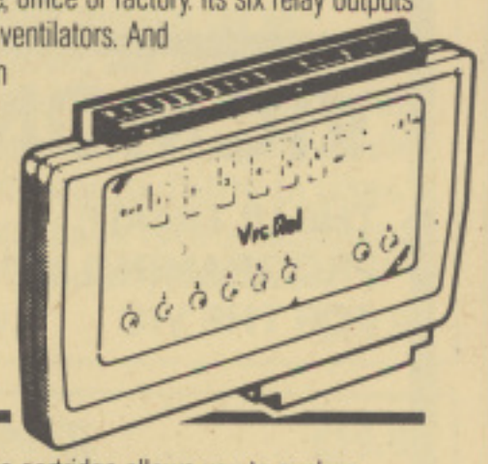

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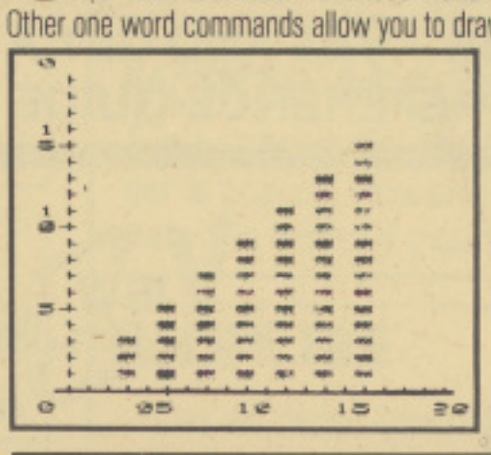

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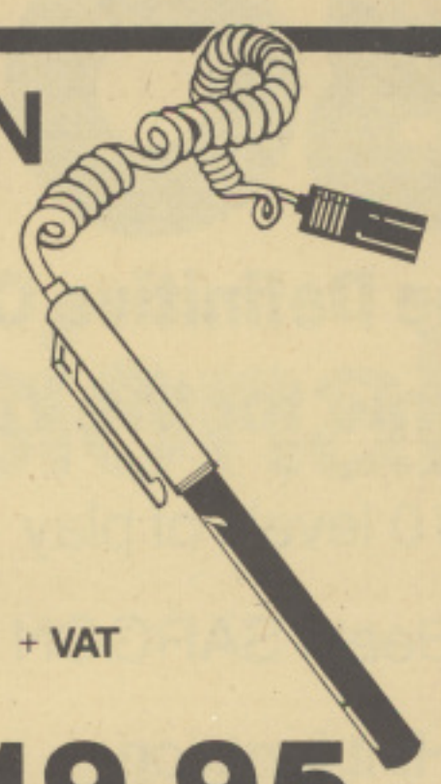

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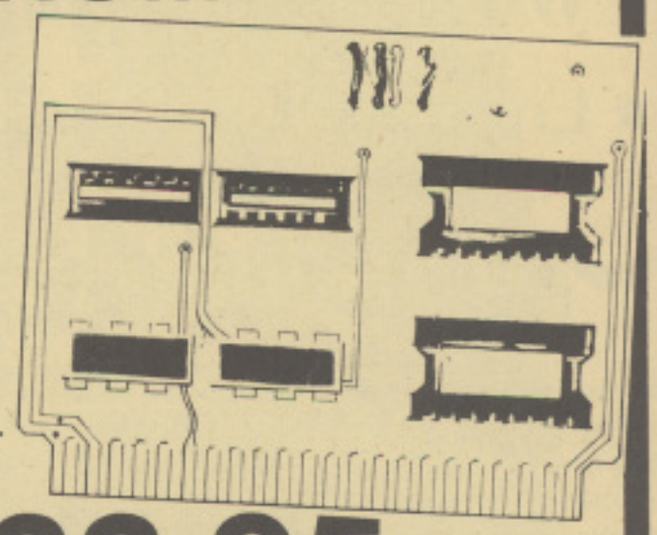

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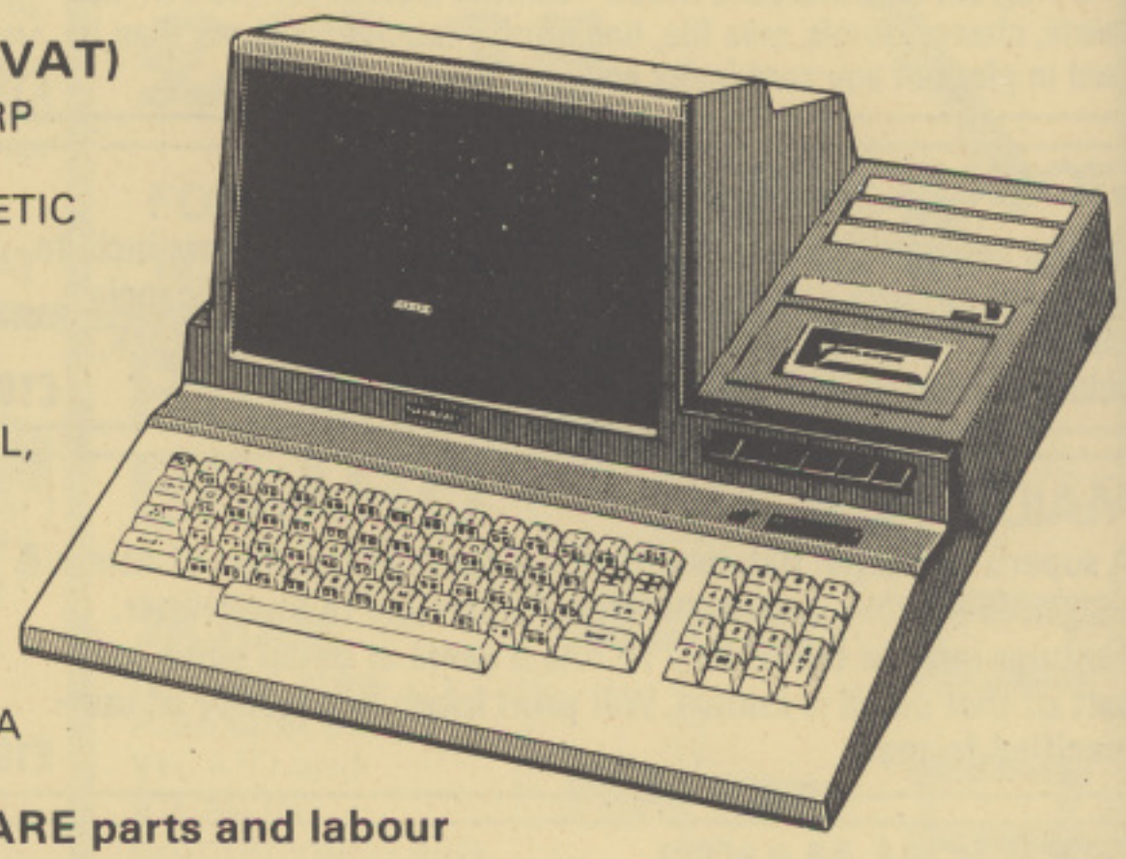

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READ/WRITE

LASERS Fight back

I was quite amazed, and not a little grieved, to read Sheridan Williams' serious allegations that LASERBUG is not an independent user group *(Read/Write, September)*. I would like to make the following points:-

1. LASERBUG is, and always has been, *totally* independent of all outside bodies. The closest connection we have ever had with Computers For All is that Trevor Sharples, LASERBUG's first editor, had a friend who worked for that company!

2. LASERBUG has never recommended its readers to buy chips from C.F.A., and indeed, the only mention for these products has been in C.F.A.'s own advertisements. Incidentally, Sheridan should make clear that although buying BEEBUG's chips will save money, fitting them will invalidate the computer's warranty.

3. LASERBUG is a non-profit making organisation, producing a monthly magazine and arranging meetings. BEEBUG, on the other hand, sells software for profit through the magazine – not a practice I approve of.

Any readers who would like to know more about LASERBUG's activities are welcome to write to me at:

LASERBUG, 4 Station Bridge, Woodgrange Road, Forest Gate, London E7 0NF.

As a final plea I say to Sheridan: stop trying to stir up bad feeling among our two groups and let's work together, concentrating on working to the mutual benefit of all BBC Micro owners.

Paul Barbour,
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National Semiconductor (UK) Ltd.,
Greenock, Scotland.

Mr. Thomson has put paid to Inside Trader's rhetorical question about the number of registers on Nat. Semi's new 16032 chip. It appears from the spec. sheets he enclosed (and it even took Tommy three hours to decipher them!) that the chip does have sixteen 32-bit registers.

Learning to program

I am hoping to emigrate to the U.S.A. within the next 12 months, and would like to learn computer programming with a view to taking up employment in this field in the States.

I passed an aptitude test with a firm in Birmingham but their couse, mostly by correspondence, would have taken at least 12 months. I have also applied to go on a full time course with Control Data Institute, only to be told I am too old (at 35!) If you could offer any help or advice I would be very grateful to hear from you.

Also, I am planning to buy a home computer, primarily as an aid to learn computing, and would welcome any advice on which to buy.

A. Claughton,
Swanwick, Derby

Quite simply, the best advice we can offer is that you go ahead and buy a home computer, along with a good book on programming (The Computer Bookshop in Birmingham probably have the largest range). You will learn much faster, and what you learn will be more relevant to microcomputers than if you go on a course.

Most home computers are suitable, though those with good screen editors (such as the VIC and BBC) make for easier program development.

User-unfriendly

"Program in two parts. Type 'Load & Return' to load 'VIC Demo'. Type 'Run & Return' to load demo."

The words above are reprinted verbatim from the label of the demo tape which The Commodore (UK variety) sends to dealers. Many who might sell VICs also might not know much about punching buttons on a computer. So what do you suppose happens whey they try to follow those instructions on the cassette? How do I make upper and lower case? Oh well, I'll type quote LOAD & RETURN unquote. Hmmmm.

Furthermore, the program is one of those programmer's ego trip things, with minimal appeal to the potential customer's desire, perhaps, to do something creative him/herself. *And* the program has clever tricks to prevent investigating it. (Why?) *And* the 2nd part loads automatically, so all one really does is press shift with RUN/STOP, then PLAY on the recorder, then sit back and wait.... and wait.

The program requires the 16K module, but it is written, we find, very wastefully ... no doubt could be crammed into much less.

Is there anyone at Commodore who checks what goes out to dealers? Who cares? Would sour grapes from a magazine help? No, but ....

It's been a constant source of amazement to us (and not just in the case of Commodore) that with the vast amount of sophisticated games and utility software available, the sales demonstration programs consist of a number of obscure graphic tricks that would only appeal to a programmer. And as for "LOAD & RETURN" – it just shows the thing was never tested out before publication by anyone but enthusiasts.

Artistic Tantrum

'Ere wots this in Inside Trader about my production of Toad of Toad Hall being third rate? Admittedly the cast of computer journalism's rats, weasels and ferrets may not have reached the very pinacles of fine art, but my boys and girls of the Chelsea Players showed a standard of professionalism in their sensitive interpretation of the characters that had to be seen to be believed.

Ben Wooley,
Artistic Director,
Toad of Toad Hall (V2.7)
c/o Datalink Magazine, London

True, true.

Veracity questioned

I read with considerable interest the "Encyclopaedia of CP/M" in your August issue. Overall, I felt it was an interesting and entertaining feature, but I would like to draw your attention to the section on programs which contains one major error in particular which I should like you to correct in your next issue.

Your writer asserts that the current version of CBasic is release 2.08, retailing at around £65. In fact the current release is 2.8 and retails at £94. (I might mention at this point that Tamsys are main UK distributors of Digital Research software products.)

A number of other items in this particular section are also surprising. I know of no particular difficulties in obtaining dBase II or Supercalc, and I find a number of the quoted prices a little odd, notably Pascal/MT+ for which the retail price (including SPP) is £299.

David C. Atkinson,
Tamsys Ltd.,
Windsor, Berks.

Bargain

Can I take an opportunity to thank you and Mr Chappell for the article on 'Discounted Cash Flow', in particular and, more generally, for several recent articles which are both eminently readable and highly instructive. You have a tutorial style that I find very amenable – when I tell you that I am 62 year-old marketing manager, with no knowledge of computers or writing programs until we acquired a PET/Disk/printer two years ago, you will realise that I need all the help I can get! You make it easy to study and understand your code so that useful routines can be added to one's repetoire.

As for 'D.C.F.', you will perhaps be pleased to know that I have already turned it to an effective business use. I sell industrial burners that give energy saving advantages. They are high cost items but the savings are readily quantifiable and can be presented as a simple 'x' years payback. However, the facility of letting potential buyers see the implications of a D.C.F. on the screen, and the flexibility of your menu has proved to be an admirable sales device which, for the time being, cannot be matched by our competitors. I

READ/WRITE

The Editor welcomes your letters, but if you require a personal reply please enclose an S.A.E.

think I got a splendid bargain for the price of one issue. I've given myself the task, as you suggested, of adding code for a print-out.

I hope to see more of your articles in the future. Meanwhile, thanks again.

Stephen Fearnley,
Halifax, West Yorks.

Thanks for the praise, Stephen – usual cheque in the post.

Dubious practice

The following letter was received from a PR company, together with a photograph and 'news story' about a new company – The Micro House.

We leave it to readers to draw their own conclusions regarding the practice certain other magazines have of inviting PR companies to write their own news stories.

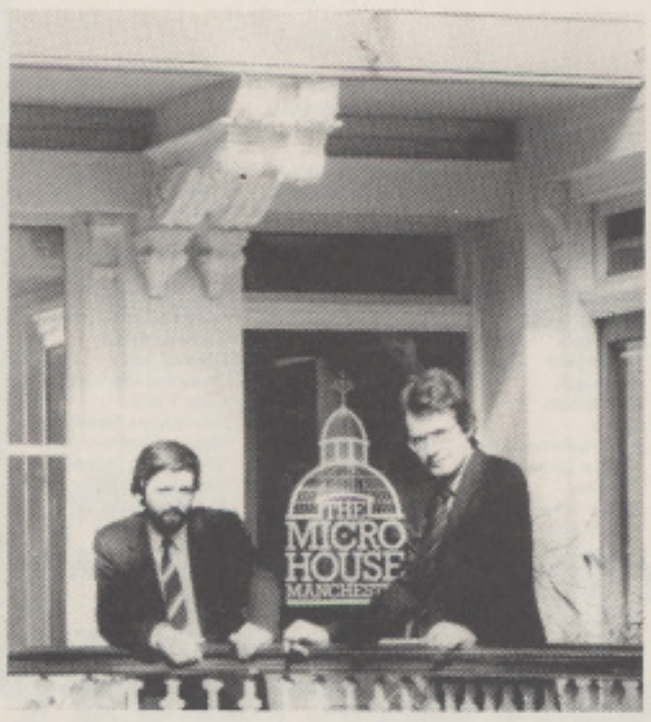
Dear Sirs,

We enclose a release plus photo on behalf of our clients, The Micro House.

We must in fairness warn you that this story as it stands has already been sent to the magazine, Micro Decision, and it was at their request that we drafted it as a story rather than a fact sheet (our normal practice with experienced journalists like yourself).

However, it does contain most of the salient facts. We or our clients will be glad to supply any more, so don't hesitate to buzz us or ask for more photos.

John Sims,
Words & Pictures,
36/38 Barton Arcade Chambers,
Barton Square, Manchester M3 2BH



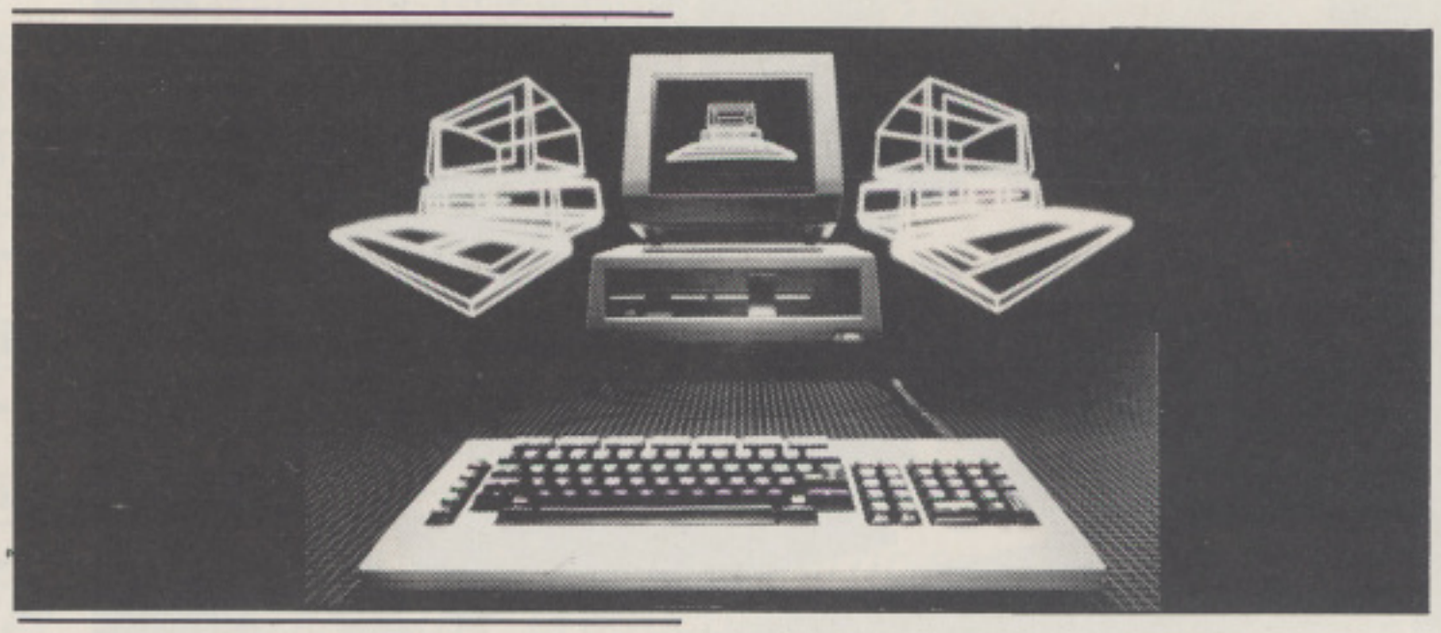
Self-importance

I am just writing to say that I haven't got a PET or a VIC, or even an Atari. In fact, I have a DAI. I therefore find that your articles on these 6502 based machines although academically interesting, somewhat irrelevant to where I'm at in programming. However, I must confess that I'm totally addicted to your style and your overt cynicism with the micro industry and the world in general. Keep it up! Otherwise we might all come down with a bad dose of self-importance. Seriously though, the articles on program etiquette et al. are good and much nicer than their textbook equivalents.

Oh, while I'm writing, I suppose I might as well just mention the DAI UK User Group. Anyone interested please write. If anyone else in Britain has a DAI that is.

Dave Atherton,
16 Douglas Street,
Atherton, Manchester M29 9FB

DAI? – Never heard of it.



Beep

I had this terrible dream; I was trapped in the bottom of a Space Invaders machine, and the little green intergalactic Munchkins were coming to eat me alive. When I woke up the cat was eating my toes...

I sighed with relief. Then I remembered I haven't got a cat and started to panic again. Maybe it *was* the little green intergalactic Munchkins, only I wasn't trapped in a giant video game, they were real and coming to conquer the world.

Us students of The Beano and similar know this is no joke. I haven't found any more evidence to support my theory yet, but I think they sneak down to Earth and live in electronic devices, waiting until the moment is right to strike. I know for sure there's something really horrid in my TV set. At first I thought I might have tuned into Des O'Connor by mistake... I think they're beginning to suspect. If you don't hear from me again you'll know they got me.

That, or your cheque bounced...

Richard Nichols
Beep

Totally legless

We act for the Right Reverend Martin Banks D.D., Vice-Prebendary of Climping-upon-Sea. Our client is a distinguished cleric of untarnished reputation. The fact that he suffered the loss of his legs in an accident with a trolley bus some years ago might lead your readers to suppose that the Vice-Prebendary is one and the same as the Martin 'Legless' Banks whose extraordinary adventures are chronicled in your journal.

We should be obliged if you would make it clear that this is not the case.

We are instructed that failure to do so may result in proceedings being taken against you by our client in both civil and ecclesiastical courts.

Ogus and Alse
Solicitors

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Robin Parker,
Heronview Limited,
3 Errol Street,
London EC1Y 8LX

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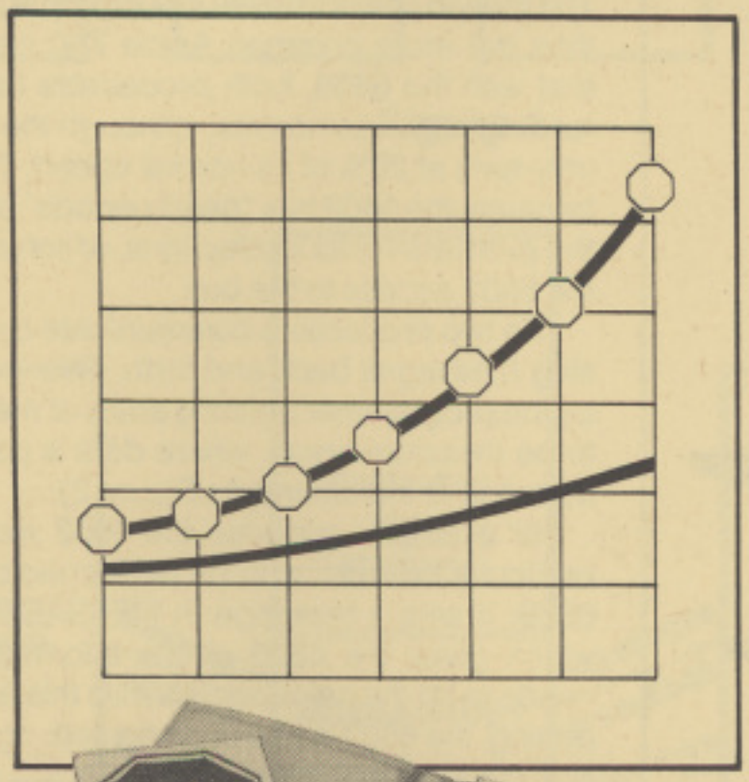

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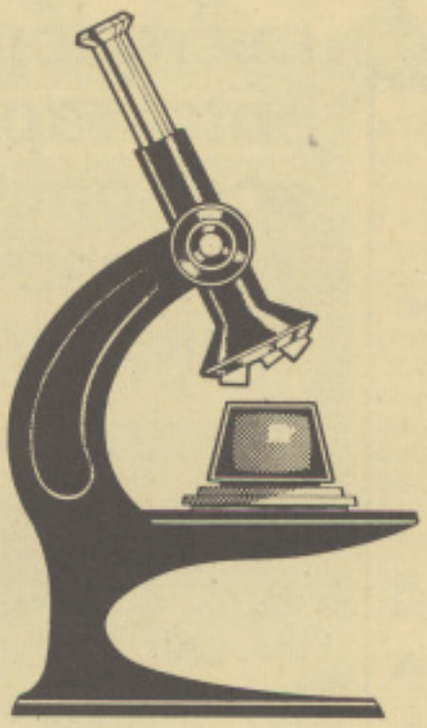

The technology of microcomputers is changing – and a whole new generation of faster, better designed machines is emerging. But how many of the new features are significant to the first-time buyer, as distinct from the computer scientist? In the second part of this series, ***Chris Preston*** *looks at multiple processors: how they work and what difference they make.*

Many of the most popular micros now offer some sort of "second processor" option. This may be a facility which was designed into the machine on the drawing board, or it may be that somebody quite independently had a brainwave. In this article we will be looking at the advantages of having a second processor, and examining some particular examples.

When we talk about a second processor, we really mean another microprocessor, usually in the same case as the original, and often sharing the computer resources such as memory and peripherals. I know that most printers have a processor in them, and the Commodore disk drive for example has two, but these do not count because they are really completely separate from the computer and do not really change how it works.

In fact even the term "second processor" is a little inaccurate, because my humble Apple (which I use for typing these gems that the Editor is so desperate as to print) contains no less than four processors! It has the original 6502 of course, a Z80 which allows me to run CP/M programs, a 6809 and a 6504 which is used purely as a keyboard controller. In addition, I hear that somebody has brought out a 68000 card for the Apple! Perhaps we should just talk about "extra processors".

A second processor does not have to be a different type to the original one. I used to use an old S100 bus computer which had an 8080 central processor controlling the screen and disks, but you could add an extra communications card containing another 8080 which emulated many of the IBM mainframe protocols, allowing the machine to be used as an intelligent terminal.

Speed-up device

Second processors fall into two main groups. Firstly, there are those such as the Apple Z80 softcard and the PET Z80 softbox, which, when running, take complete control of the machine, handle all the processing, control the peripherals and so on. The second group are those which improve the performance of the computer by taking over time-critical functions. An example of this is the Apple 6809 card, which can be used as a "speed up" device for PASCAL users. This works by having the (faster) 6809 perform all the arithmetic calculations, while leaving the (slower) 6502 to perform tasks such as handling the keyboard, where speed is not important. Incidentally, this idea is not restricted to microcomputers, DEC provide an "add-on" hardware unit for the PDP-11 which performs floating-point arithmetic, rather than using a long slow software subroutine.

How does a typical second processor system work? Figure 1 shows a block diagram of a system such as the Apple 6809 card, where the 6809 shares all the memory and peripherals with the 6502:

The reason I have chosen this example rather than the more common Apple Z80 card, is that with the 6809, both processors can be running at the same time, although the 6502 only runs at 20% of its normal speed. This is because the 6809 has "dead periods" during the execution of its instructions, which allows the 6502 access to the bus.

The two processors communicate by passing messages back and forth. This is done by the programmer defining areas of memory to be message areas, where data is passed from one to the other (see Figure 2):

For example, suppose the 6502 wants a particular calculation to be performed by the 6809. It sets a message in MESSAGEOUT, which gives the 6809 all the information it needs to do the calculation. While this is happening, the 6502 is free to do something else, scanning the keyboard, or even doing some more calculations of its own. When the 6809 sees that there is a message in MESSAGEOUT, it takes the data and starts calculating, and when it has the results, it puts them into MESSAGEIN, ready for the 6502 to pick up. After it has finished the calculation, it may go back to doing something else, or it may just sit waiting forlornly for another message (rather like Tommy on a day when nobody writes to him). We can show this process by means of a flow-chart – Figure 3:

The two processors act like two people playing a game of chess by post. When a letter arrives from his opponent, a player indulges in a flurry of activity, works out a move and sends it off. He then returns to his 'background' occupations, eating, sleeping, going to work etc. until the next letter arrives.

In this case both processors share memory, but this is not always the case. An example of a very specialised second processor with its own memory is the keyboard controller on my Apple. On the Apple, the keyboard is normally controlled by some logic, and appears from software as two memory locations. The first of these contains a flag to say that a key has been pressed, and the code for that key. The second location is just used to clear the flag when a program has read the key value (see Figure 4):

We can think of the keyboard as being at the end of a tube, with the Apple just looking at what comes out of the tube. The Apple itself is not concerned with what is at the other end of the tube, only with the data coming out of it, as in Figure 5:

The keyboard controller replaces the logic, but manipulates the two memory locations in exactly the same way, so that no program changes are needed. Thus, as far as the Apple itself is concerned, nothing has changed. However, the processor in the con-

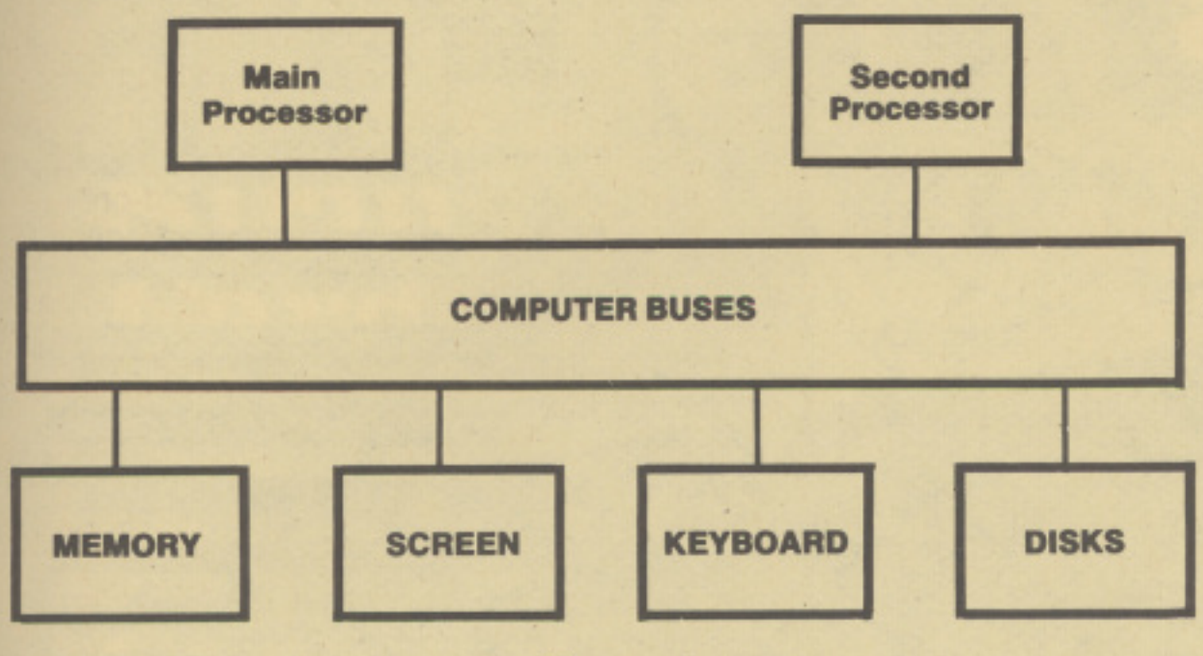

Figure 1

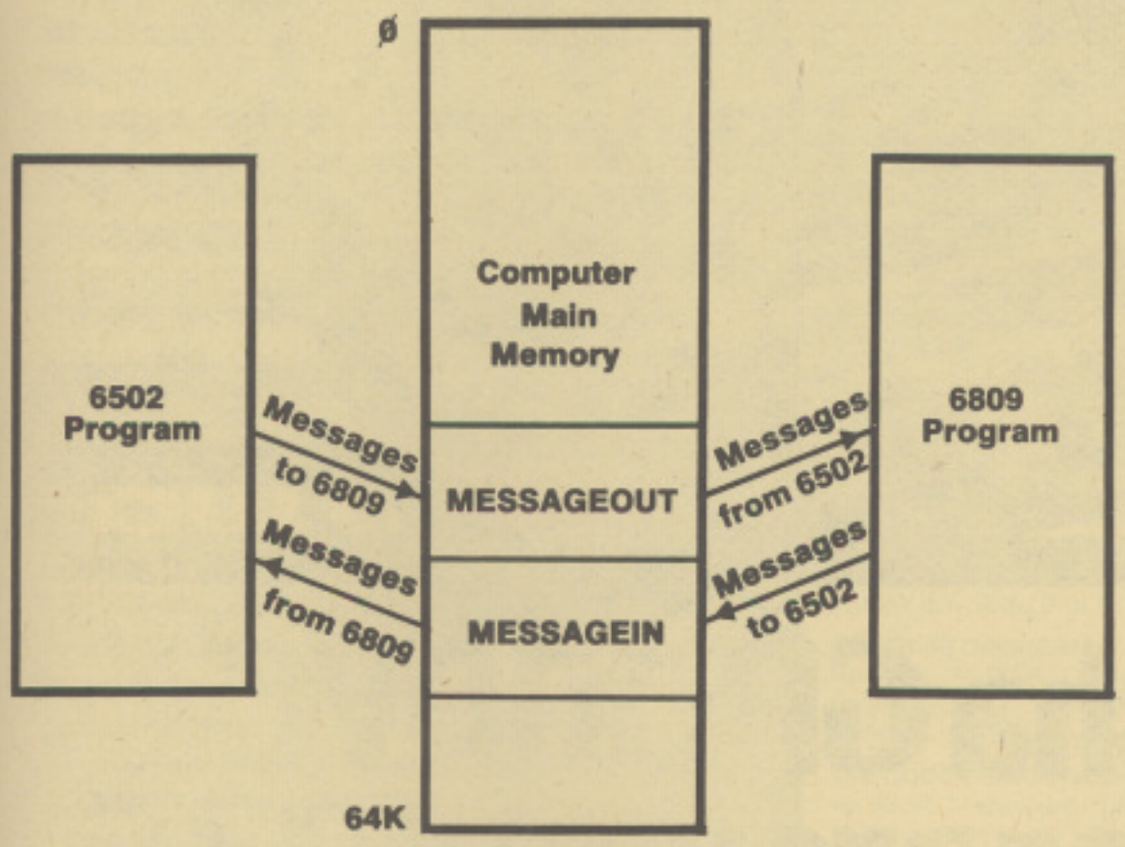

Figure 2

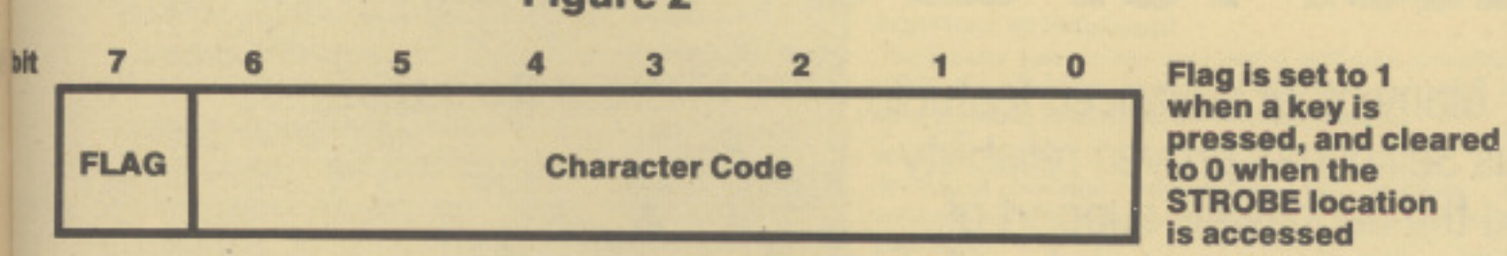

Figure 4

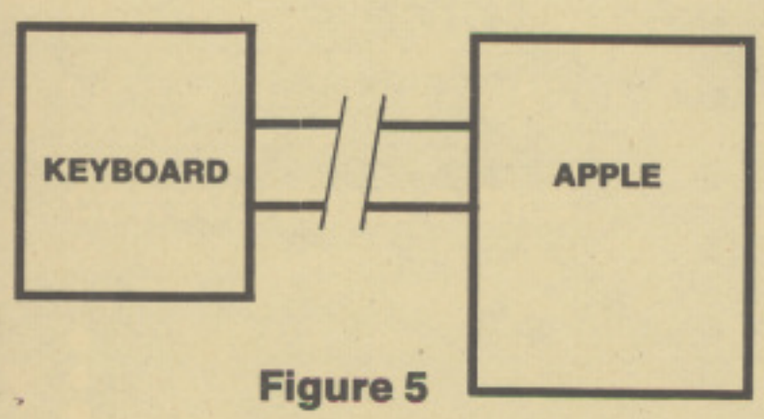

Figure 5

troller, a 6504, means that the unit is a lot more powerful than the standard Apple keyboard. I can now type ahead, that is, I can be entering data while the Apple is busy doing something else, whereas the old keyboard could only remember the last key pressed. I can also reprogram keys, so that if I am working on a program called RADIUS CALCULATIONS, I can type in a CNTRL-Q character (which is normally not used) and instead of RUN RADIUS CALCULATIONS or CNTRL-W instead of SAVE RADIUS CALCULATIONS – a great saving for one-fingered typists like me!

The Tube

Talking about tubes leads us, of course, to the Tube, which is a feature provided on the BBC Micro to allow the adding of a second processor. Like the analogy above, we can consider the Tube from the point of view of the main 6502 processor. It can send information down the Tube to another processor, and then get on with something else until the answer comes back. The advantage of this system over, say, the Apple 6809 board we

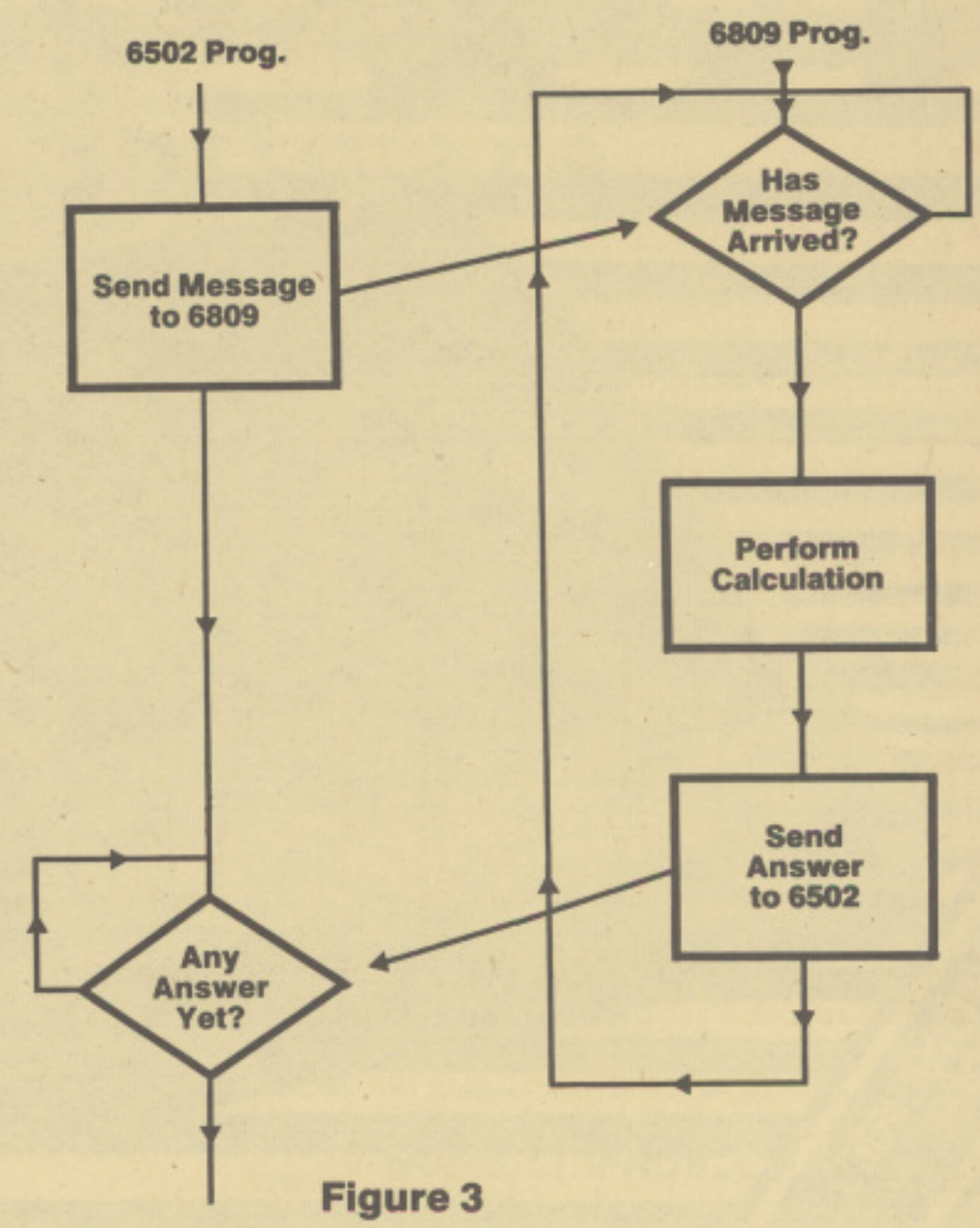

Figure 3

described above is that it does not matter what is on the other end of the Tube, so long as it follows the rules. It could be another 6502 or a Z80 for CP/M, but whatever it is, it will have its own memory, so we can in effect add another 64k to the machine. We could add an intelligent add-on memory unit, which might allow us several memory blocks of 64k each, with some sort of paged access system.

In fact, Acorn are producing a unit with a 16032 microprocessor, which is a 16-bit device capable of addressing 16MB of memory, and of course, running many times faster than one of the existing 8-bit chips. This processor will support PASCAL, FORTRAN and COBOL plus several other high level languages. This will be organised along the same lines as the PET Z80 softbox, where the "computer" is used only as a terminal, with all the work being carried out in the unassuming black box hidden under the table!

So we can see from this short survey, that there are many types of "second processors", which perform a wide range of functions, some of which may not be immediately recognisable as such. With the cost of hardware plummeting as it is, we will see more multi-processor computers, with one chip for the keyboard, another to handle the screen, another to drive a communications interface and possibly more than one to carry out the actual computing part of the operations. If you take a large program, with several subroutines executed one after the other, and imagine how fast it would run if each subroutine was executed at the same time by separate processors, you will get a feel for the true power of multiple processors. ●

VIC-20 USERS

DEALER ENQUIRIES WELCOME.

The new Seikosha GP-100VC graphics printer for around £235. EX. VAT.

Offering big printer performance at a fraction of the cost, the latest addition to the famous range of Seikosha micro-printers is the 100VC. The precise match for the VIC 20.

Featuring all the VIC 20 characters, symbols and graphics as standard, the Seikosha 100VC includes full graphics capability. It enables graphic, character and double width character modes to be intermixed on a single line as well as repeating graphics data, as you want, with a single command.

Many other advanced features, plus Seikosha's proven reliability and the nationwide support of DRG's distributor network make the 100VC the natural choice for the VC10 user.

DIMENSIONS:

Depth – 9¼" (234mm)

Width – 17¼" (420mm)

Height – 5¼" (136mm)

OPTIONS:

Interfacing for most other systems available on the GP100A model.

FEATURES INCLUDE:

- 80 col. 30 cps.
- Dot Matrix unihammer action.
- 154 characters (inc graphics)
- VIC-20 8-BIT CODE
- Full graphics.
- Double width printing.
- Automatic printing
- Up to 10" paper width.
- Original + 2 copies.
- Tractor feed.
- Self testing.

DRG BUSINESS MACHINES

Telephone the number below and we'll tell you where your nearest distributor is located. See the remarkable Seikosha GP100VC in action

(Peripherals & Supplies Division) 13/14 Lynx Crescent, Winterstoke Road, Weston-super-Mare, BS24 9DN. Tel: (0934) 416392.

THE FINEST WORLDWIDE SUPPORTED NATIONWIDE.

DRG (UK) Ltd, Reg No. 22419 England.

CP/M 80 for the Sirius 1 and the PET

Sirius 80 Card

- Allows all standard CP/M 80 2.2 software to run without modification.
- The card simply plugs into any one of the four internal expansion slots and comes complete with a disk containing all the usual CP/M utilities.
- By typing a single command, the system can alternate between CP/M 80 and CP/M 86. Files generated under either CP/M are identical in structure, providing file compatibility between operating systems.
- The card also has a Corvus hard disk interface allowing the CORVUS range of Winchester drives to plug directly into the SIRIUS.
- Z80 4 or 6 MHz with no wait states.
- 64K RAM. Corvus hard disk interface.

Sirius 80 card (4 MHz)..... £299.00
Sirius 80 card (6 MHz)..... £335.00

Softbox

Simply by plugging the SMALL SYSTEMS SOFTBOX into the PET IEEE port and loading the CP/M disk, the PET will run under the world's most popular disk operating system, CP/M™. No internal connections or modifications to the PET are required.

Application packages designed to work with specific terminals (e.g. Lear Seigler ADM3A, Televideo 912 or Hazeltine 1500) will need no modifications to work with the PET screen, as the SMALL SYSTEMS SOFTBOX allows the PET screen to emulate any of these devices.

- Full 60K byte RAM
- CP/M version 2.2
- Z80 CPU running at 4 MHz with no wait states

new low prices!

Softbox..... £495.00
Softbox with RS232 interface ... £495.00

STAND ALONE CAPABILITY

The Softbox, in conjunction with a standard VDU, will operate as a stand alone CP/M system with built in IEEE-488 interface operating with .5 MByte floppy storage or up to 80 MBytes of hard disk storage.

CORVUS HARD DISKS

Well proven systems with nationwide support and maintenance.

- 5, 10, 20 MB capacity.
- Up to 4 drives can be daisy chained.
- Back-up onto standard video cassette using the Mirror unit.
- Up to 64 users with the Constellation multiplexer unit.

5 MB Corvus Drive..... £2295.00
10 MB Corvus Drive..... £3595.00
20 MB Corvus Drive £4495.00

CP/M Software

LANGUAGES

ALGOL-60 (Research Machines) £130/£20
ALGOL is a powerful block structured language featuring economical run-time dynamic allocation of memory. The compiler is very compact (24k) and supports almost all Algol 60 report features.

C COMPILER (BD Software) £80/£15
This compiler supports most major features of the language including structure, arrays, pointers and recursive function evaluation. The compiler produces compact, relocatable 8080 code for use with the linker and library supplied.

CBASIC Compiler Systems £75/£12
This is a non-interactive BASIC used by many business application programs. It supports full file control chaining formatted output and random disk file access, 14-digit arithmetic WHILE/-WEND and optional line numbering.

C COMPILER (Whitesmith's) £455/£25
This compiler conforms to the full UNIX version 7 implementation of the C language, which has more facilities than Pascal or BASIC and produces faster code.

S-BASIC £195/£20
A structured BASIC compiler generating 8080 native code, combining structured programming and the speed of machine code while maintaining the convenience of BASIC.

BASIC-80 (Microsoft) £175/NA
This is Microsoft Extended BASIC interpreter, version 5. It is a powerful, ANSI compatible disk BASIC with many features not found in PET BASIC, such as WHILE/WEND, chaining, variable length file records, double precision floating point, PRINT USING facility, error trapping, hexadecimal numbers and more.

BASIC COMPILER (Microsoft) £205/NA
This compiler is language compatible with the Microsoft version 5 interpreter but generates 8080/Z80 machine code, so that program execution is typically 3 to 10 times faster.

COBOL-80 (Microsoft) £375/£20
An ANSI '74 COBOL compiler producing relocatable modules compatible with FORTRAN-80 or MACRO-80 output. COBOL-80 has a complete ISAM facility and interactive screen handling.

CIS-COBOL (Microfocus) £425/£30
An ANSI '74 standard COBOL compiler fully validated by U.S. Navy tests to ANSI level 1. The compiler also supports many features of level 2 including dynamic loading of COBOL modules and a full indexed Sequential (ISAM) file.

FORTRAN-80 (Microsoft) £230/£20
The popular science and engineering language, complying with the ANSI '66 standard (except for the Complex data type), with enhancements such as mixed mode arithmetic.

PASCAL/MT+ £375/£20
A Pascal compiler meeting the ISO standard, with many enhancements including full string handling capability and random access files.

PASCAL/M £220/£15
This compiler produces p-code and is an extended implementation of standard Pascal, with long (32-bit) integers, a SEGMENT procedure type (for overlays) and an added string data type.

PASCAL/MT £160/£20
This is a subset of standard Pascal, which generates ROMable 8080 machine code and supports interrupt procedures, CP/M file input/output, and assembly language subroutines.

PASCAL/Z (Ithaca Intersystems) £225/£20
A compiler producing ROMable, re-entrants Z80 micro-code highly optimised for speed, supporting variant records strings CP/M file input/output, and assembly language subroutines.

PRO PASCAL £190/NA
This Pascal Compiler implements the full proposed standard with improvement extensions such as random access files, strings and program segmentation. Pro Pascal is designed specifically for the Z80 and produces relocatable machine code which is very fast and compact. A linker and cross-reference generator are provided, and Pro Pascal object code may be used in READ only memory.

muLISP £110/£15
LISP is an interactive programming language widely used for artificial intelligence applications.

PL/I-80 (Digital Research) £325/NA
A general purpose application programming language giving mainframe capability for developing large-scale structured programs in a microcomputer environment.

TINY C TWO £130/£30
A compiler written in TINY C. The source code is included on disk.

WORD PROCESSING

WORDSTAR (MicroPro) £255/£35
A powerful screen-oriented word processor designed for non-technical personnel. Text formatting is performed on the screen, so that what you see is what your print-out will look like. WORDSTAR'S advanced facilities include justification, pagination, underscores, boldface, subscript and superscript, block movement of text.

WORDINDEX (MIDAS) £150/NA
A program to assist WORDSTAR users by generating a table of contents and index from a WORDSTAR document.

MAILMERGE (MicroPro) £80/£15
MAILMERGE is an add-on utility for WORDSTAR users allowing the production of personalized form letters or other documents from a mailing list made using DATASTAR or NAD. Requires WORDSTAR.

MICROSPELL £165/NA
This is a spelling help program which scans through a document file stopping at each dubious word, offering correctly spelt alternatives and allowing you to correct the word with a keystroke.

TELECOMMUNICATIONS

BSTAM £115/NA
This telecommunications utility permits any type of CP/M file to be transferred to or from another computer also equipped with BSTAM. Transmission occurs at full speed with CRC error checking and automatic error recovery.

BSTMS £115/NA
An intelligent terminal program permitting communication with a mainframe computer.

NUMERIC PROBLEM SOLVING TOOLS

T/MAKER II £185/£15
An advanced utility for preparing management reports with tabular data, combining visual calculator with a full screen editor.

MICRO MODELLER £595/NA
The number one Financial Modelling and forecasting program.

ANALYST (Structured Systems Group) £130/£15
A customised data entry and reporting system in which the user specifies up to 75 data items per record, and can use interactive data entry, retrieval and update facilities to make information management easy.

muSIMP/muMATH £140/NA
A package of programs including muSIMP, a high level programming language for symbolic and semi-numeric processing, and muMATH, an interactive symbolic mathematics system written in muSIMP.

STATPAK £260/£20
A professional statistics and probability package which can rapidly handle large files of data.

DATA MANAGEMENT SYSTEMS

dBASE II £385.00
An interactive relational database management package with full screen formatting and its own fully structured high level command language. Interactive data entry and Validation with WordStar-like commands. Allows you to develop application packages in days rather than months.

MDBS £675/£30
Micro Data Base System is a full network data base with all the features of HDBS, with fixed or variable record length, read/write protection at the ITEM, RECORD, SET and FILE levels.

LANGUAGE APPLICATION TOOLS

FORMS 2 for CIS Cobol £120/NA

FABS £115/£15
FABS gives you rapid access to large data files by using balanced tree structures containing up to 65,000 records. Instructions are included for use with CBASIC2, S-BASIC, BASIC-80, BASIC compiler, PL/1-80, Pascal/MT + and FORTRAN-80.

M/SORT FOR COBOL-80 £130/£12
A record sorting utility for COBOL-80 conforming fully to the ANSI '74 level 2 sort/merge standard (except for alphabet name collating sequence).

SYSTEM TOOLS

CROSS ASSEMBLER £95/£10
XASM 05, 09, 18, 0 48, F8, 65, COPS 400 and 51
Cross assemblers for the Motorola 6505, Motorola 6809, RCA 1802, Intel 8048, Motorola 6800, Fairchild F8, MOS Technology 6502, National Semiconductor 400 and Intel 8051 families.

BASIC 48 - Enhanced Basic Compiler £195/£10
Produces highly optimized assembly source for 8048 family. Includes XASM48.

small systems engineering limited

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When to buy?

Is this a good moment to buy a new computer?

It rather depends on what sort of computer it is you want.

For beginners armed with no more than £50 and a burning desire to learn, the answer is *probably*. Uncle Clive has dropped the ZX-81 price to £49.95. *But* there should be at least one more micro in this category on the market by Christmas.

With a price war raging in the £200 bracket, home computers look like a good buy. The *Atari 400* and *Texas Instruments TI99/4A* are locked in mortal combat, with *Commodore's VIC-20* – also priced at £199 – holding its ground. A new combatant is Dragon, of whom more anon.

One of Atari's strong points is a certain indefinable glamour. Their graphics have the edge too, in our opinion. The *VIC-20* offers the widest range of add-ons, but it is unlikely the system will last much beyond the end of the year. A new 16K VIC-40 already lurks in the background ready to replace it. That said, I wouldn't be surprised if another £30 or so was shaved off the VIC-20 price soon.

The Texas machine seems to be supported only by peripherals of T.I.'s own manufacture. However, some of these – the speech synthesiser, for example – are extremely sophisticated.

Confusion reigns in the next category with Acorn's BBC micro under attack from all sides. The prevailing opinion seems to be that the cheaper *Sinclair Spectrum* offers rather better value than the *BBC Model 'A'*. Sales of the superior – and frankly excellent – *Model 'B'* continue to be dogged by delivery problems and rows with the trade.

Plenty of competition from several new machines in this area, most of them as yet unsupported by any software. Our advice is to let the dust settle for a month or two. There could be some juicy cut price offers just before Christmas, with even more £££'s knocked off after.

The £700-£1,000 price category is in transition. Apple have knocked a third off their prices but have a new machine, the Super II, up their sleeves once existing stocks can be cleared (more price cuts?). Most of the PETs, Genies and competing systems are due for imminent replacement.

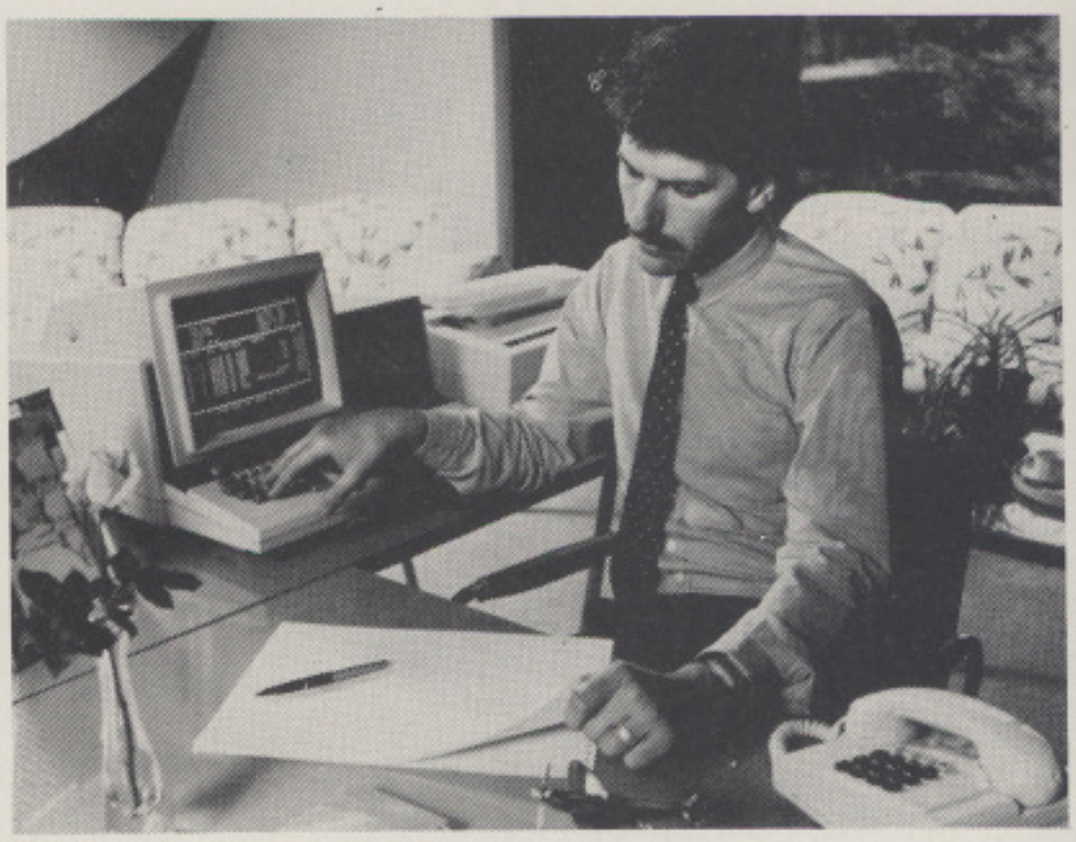
£1,500 + VAT is as much as you should pay for a small 8-bit system with built-in screen and disk drives. It should secure you a SuperBrain these days. A little less – £1,250 + VAT – buys a newly facelifted Osborne 1 and a handsome pile of software.

In the £2,000 to £3,000 bracket, sales of 8-bit machines, including several Japanese contenders, have slumped before the onslaught of 16-bit micros like the Sirius and IBM Personal Computers. Olivetti and Keen are both working up 16-bit business, with first deliveries of the DEC Rainbow also expected shortly.

Since 16-bit software is at last beginning to flow, this looks like quite a good moment to buy.

If you are thinking of spending more than £3,000 on the basic system, our advice would be to wait. Prices haven't fallen as far as they will yet, and there are very real doubts about operating systems and networks.

Best advice of all: keep watching this space.



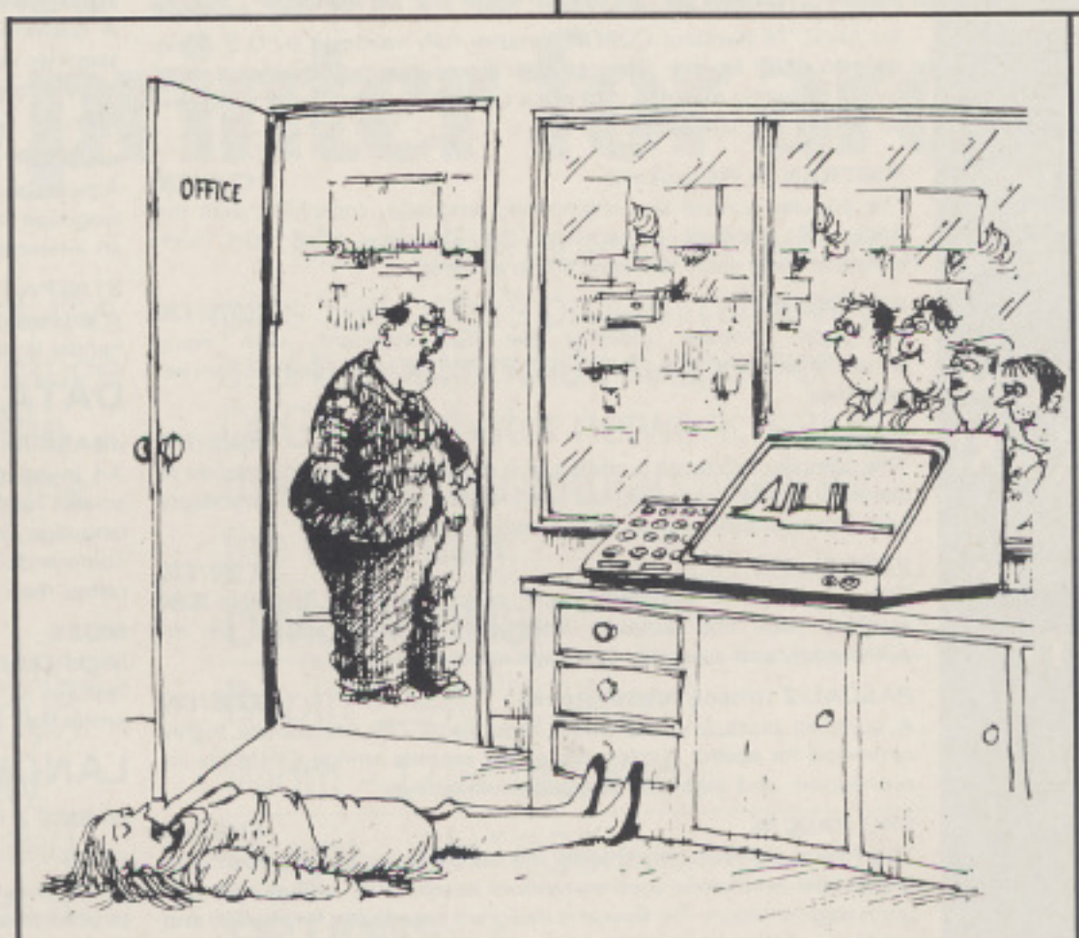
True Story

This man's moustache is worth £25,000.

He is not mad. He is Mr. John Dixon, a theatrical person hired by Canon to advertise their CX computer.

The contract stipulates that Mr. Dixon may not shave for two years.

A leading firm of Lloyds brokers has quoted us £825 per annum to insure the moustache. "The premium is computed on the basis of £1.71 per bristle over two years" say the brokers. Damage resulting from vermin, lightening, act of insurrection or invasion by a foreign power would be specifically excluded.



'All right, you lot, which one of you programmed a dead rat onto Miss Pringle's computer?'

Martin Honeysett is said to include himself, in truly Hitchcockian style, amongst the seedy inhabitants of his splendidly ghoulish cartoons.

From the pocket calculator, through home video, to Space Invader machines and back again, Martin has managed to sum up in an entertainingly graphic form, what many of us secretly feel about the new technology. The cartoons reprinted in these newspages were some of our favourites.

Balls

Goring-on-Thames, Aug. 9th.
The cobbled streets resound with rustic music and cries of merriment as the natives celebrate the reduction in price of the Sinclair ZX-81 to £49.95.

But there is one who maketh not good cheer. He is Mr. Gulu Lalvani, chief of Binatone.

It seems that Uncle Clive's daring move has robbed him of his Principal Selling Proposition – that of a sub-£50 computer.

I call in my personal soothsayer on Lalvani's behalf. The aged crone consults her balls, muttering strange incantations ("Oh mighty Wozniak...") before handing me a scroll whereon is writ the Secret.

Before despatching it to former musical toilet roll-holder manufacturer, Lalvani, I take a PEEK (what else?) at its message:

'Let your Principal Selling Proposition be that of a sub-£40 computer', it says.

Oh dear. We have it on good authority that the Timex factory in Dundee churns out ZX-81s for less than a tenner.

I fear that Gulu's next announcement could well be followed by further price reductions from Uncle Clive.

by Julian Allason

16-Bit Fever

The following is addressed to those suffering from 16-bit fever.

Loud have been the cries of scorn from manufacturers of 8-bit systems. What advantages, they ask, do 16-bit machines like the IBM Personal Computer, Sirius, DEC Rainbow and Corvus Concept, really offer? So far only the last named can promise any material increase in speed. The 16-bit bunch are more than a little embarrassed about this. Because in straight benchmark tests the 8088 based computers *aren't* that much faster than some of the 8-bit Z80 systems.

In practice the situation is a little different, thanks largely to the ability of the 16-bit microprocessors to address larger amounts of RAM memory – typically a megabyte or more, compared to 64K bytes of RAM by an 8-bit CPU. Since larger programs and more data can be held in RAM at once, less of the time-consuming disk accesses are necessary.

Not surprisingly, the 16-bit brigade have retaliated by rubbishing the 8-bit machines for inadequate memory and over-dependence on disk storage.

But all that could change. The old-time micro makers are frantically working on means of stretching the memory capacity of their machines. Tried and tested techniques like bank switching (16K banks of RAM are switched in and out as required so that the CPU never actually addresses more than 64K at one time) are being offered alongside more creative solutions. In the latter category I would place *RAM DISK*, on-board Random Access Memory that looks to the computer's operating system like a disk drive. Access is much, much faster, of course. (No offence to Barclaycard.)

Needless to say an American outfit have combined this *RAM DISK* technique with 16-bit processor in the form of the 68000 based Sage 2 computer.

Which brings us back to where we came in. Perhaps 16-bit fever is incurable after all.

I am happy to dispel any notion that the Osborne 1 briefcase computer might be less than portable. The point is, er, proved by Michael Healy, MD of Osborne U.K., Osborne competition winner Paul Gladwell, and Editor Pawson.

A spokesman for Mr. Healy's office later said that the osteopath hoped to have him back in action in no time.

Of libels and Liverpool

With every second character we write about reaching for his libel lawyer these days, I had better state categorically that any resemblance between a well known Merseyside dealer and last month's cover was entirely fortuitous, not to mention coincidental, unintentional, no resemblance to any person living or dead etc., etc.

Talking of Jeff Orr, I hear that Liverpool-based Stack Computers (tel: 051-933 5511) have their entire team of Scouse boffins hard at work on interfaces for the Sirius and IBM Personal Computers.

Since Orr is widely reckoned to have one of the keenest noses in the business, this must mean something. At any rate Stack are invariably first on the market with add-ons and, coincidentally or otherwise, every micro they have backed (PET, Sinclair, Apple, VIC) has subsequently proved a handsome winner.

In case you are wondering about the company's name, I am unreliably informed that it comes from the Orr family motto: *Stacko Alto, Vendo Cheapo* (Pile 'em high, flog 'em cheap).

At any rate I am glad to see that Stack have kept the promise they made when they launched their expandable VIC *Storeboard Memory* System in November last: RAM prices are down and the amount of RAM supplied on the basic £49 *Storeboard* has been increased from 3K to 8K. So for just a few quid more than a straight 8K cartridge, you get an expansion system with 8K RAM, ROM space and an expansion slot.

Anyway I didn't think our cover looked all that much like Jeff....

Secret Policeman's Soiree

There is just enough space for me to insinuate a brace of terminological exactitudes into this month's column. If nothing else they might serve to raise the tone. *(About time – Ed).*

Firstly, SBS does not, as Fleet Street has authoritatively stated, stand for Special Boat Squadron, or even Special Boat Service. The correction designation is Special Boat *Section*, whence I have it on good authority, this organ is closely perused.

Secondly, the initials B.O.S.S. stand no longer for Bureau of State Security; the South Africans have rechristened it to the more soothing Internal Relations Office.

No – and here comes the point *(and not before time – Ed)* – BOSS is the name of the definitive chess program for the VIC. At least it thrashed all comers at a tournament just organised by its publishers (I doubt we should have heard about it if it hadn't.)

SARGON II running on an Apple II, PETCHESS on a PET 8032 and CHESSMASTER on the TI99/4A were all set for a response time of 60 seconds. BOSS came out the clear winner, although next month's *Read/Write* column will doubtless feature complaints from the publishers of the other programs, concerning response setting, hypnotism, psychic attack and all the other exciting things that make modern competitive chess so cerebral.

Anyway BOSS costs £14.99 inclusive from Audiogenic at P.O. Box 88, Reading. And the Editor has just informed me that the South Africans have changed the name of their secret police again. This week it is the National Security Agency.

Non-electronic mail

To the Marketing Manager,
Prestel H.Q.

Dear Mr Chisholm,

Six months ago our esteemed Editor, upon whose head be peace, had one of his bright ideas.

'All the greybeards reckon Prestel is doomed,' he said. 'Let's prove them wrong with a major series on how Prestel can be used on personal computers.'

'Great idea, Chief,' I responded enthusiastically (agreeing with the Editor is, after all, a recognised path to promotion in this field). 'I will get right onto it.'

So I wrote to you.

I don't suppose a letter from a humble hack will have penetrated to your elevated office, but your minions sent me a nice printed acknowledgement saying the matter was in hand.

A month passes pleasantly. No information. I telephone. Someone will call me back. No one does.

The Editor keeps wanting to know when the first article will be ready.

'No panic, boss. Busby has it in hand,' I tell him.

At this point the Editorial winkle picker is applied to humble hacks posterior. Humble hack hurriedly writes to British Telecom's Press Officer: information urgently needed.

Another month passes. No word from Busby.

Winkle picker phobia leads your correspondent to try a new wheeze: a letter to the Minister.

The Civil Service swings efficiently into action. Two months pass.

This reporter receives a late night telephone call – "You'd better hurry – it's from the Ministry," urges panic-stricken wife.

And so it is.

There has been an investigation, says the Ministry. British Telecom never received your letters.

But what about their acknowledgement?

Long silence at other end of line.

And why, after high powered Ministerial enquiry, has Busby still not sent us all the information we asked for?

Further long silence. Perhaps I should try "other means" (unspecified).

So, Mr. Chisholm, I am trying other means. In this case an open letter through the pages of *MicroComputer Printout*.

Prestel has been less than successful, whether because no one actually needs all that information, or because the equipment has been too expensive, the access cost too high, or – perish the thought – that the marketing has been incompetent.

If any of the above *are* true, there remains one big potential market for Prestel. And it is made up of the half million or so micro computer owners in this country.

They have all got keyboards. They have all got memory. In fact they have all got most of what you need to link in to Prestel. And indeed several firms offer adaptors necessary for connecting personal computers to Prestel.

Unfortunately most microcomputer owners aren't that interested in the afternoon price on forward pork bellies in Chicago. Or the weather in Belgrade.

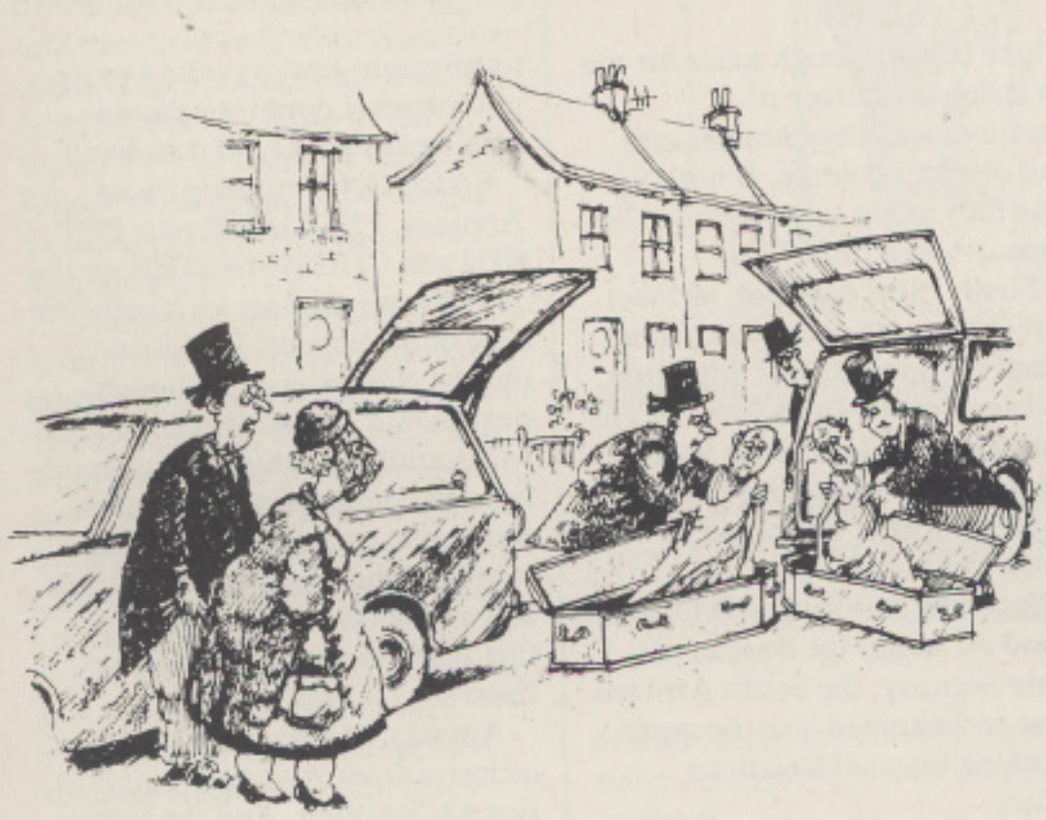
What microcomputer owners *are* interested in is electronic mail.

And who runs just the sort of public network that could be the ideal vehicle for electronic mail? Why you do, Mr Chisholm. And being a red hot marketeer you have undoubtedly investigated the possibility.

We would love to know more about it.

I – and most of the readers of this magazine – look forward to hearing from you.

Yours sincerely,
Julian Allason



'I'm terribly sorry, Mrs Nisbitt, we've had no end of trouble since we installed a computer in the office.'

Helpful word processors

'Why did you plug *WORDCRAFT* instead of our word processor?' an irate advertiser demanded recently.

Because *WORDCRAFT* is better, I replied with perhaps less tact than our advertisement manager would have preferred.

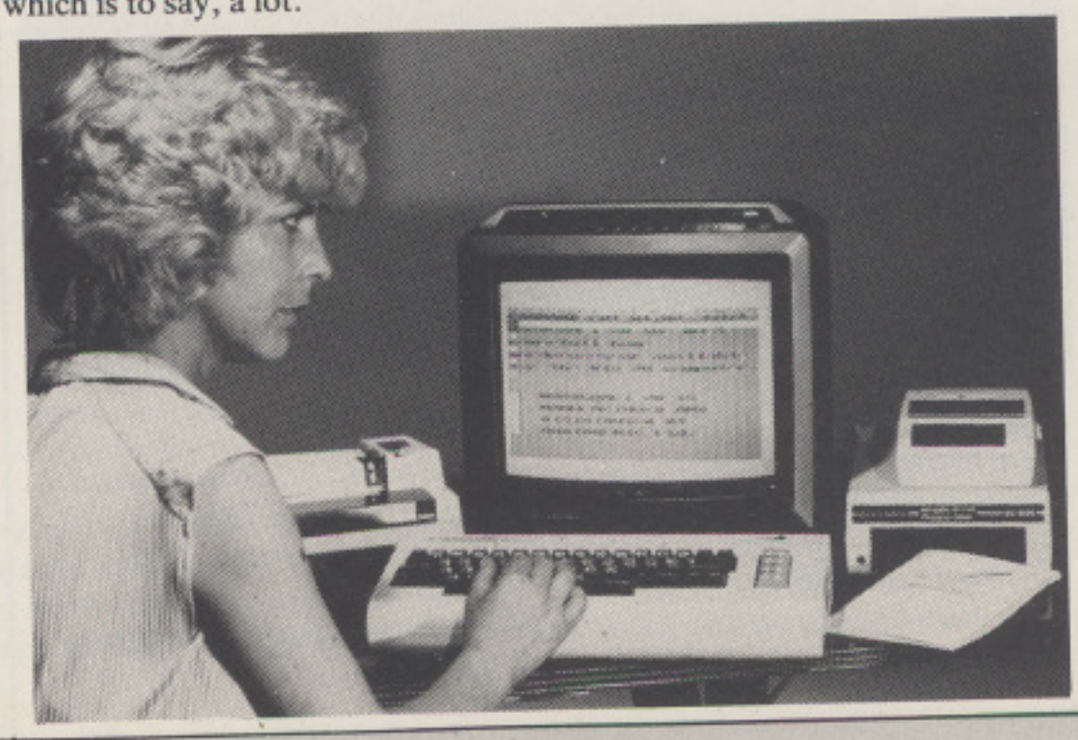
And so it rates as good news that WORDCRAFT 20 has arrived for the Commodore VIC. AT £123 + VAT for the cartridge it is certainly not the cheapest – and Commodore's own £25 word processor certainly merits investigation. But it is still a third of the price of the well-established PET version, and the manual shows that it does almost everything the big brother does – which is to say, a lot.

You'll find it at VIC dealers, or by post from Audiogenic.

My own problem with word processors is that I can never remember how to use them. This difficulty has been nearly circumvented by the authors of *SELECT*, a newish word processor with versions available for computers running CP/M and CP/M86.

SELECT actually includes its own one-and-a-half hour tutorial course, and a HELP feature. You type HELP and it tells you what to do. I type HELP quite often.

HELP...!



Sharp operator

After two years hard labour Tim Moore, Sharp dealer extraordinaire, has emerged from his cave clutching *APOLLO BAS-MOD*.

"Er, what is it, Tim?" I murmur discreetly.

"It is what you – and every Sharp MZ80A and MZ80K user have been waiting for," pronounces Moore, who, for reasons that need not concern us here, is universally known as the Bear.

"What actually does it do?" I persist.

"It gives your BASIC new commands."

"What sort of new commands, Tim?

"Things like PSIZE and WEXIT, REXIT and FEXIT."

"Sounds useful, Tim. Anything else?"

"Yes. DEEK and DOKE..."

Well, if you can make anything of this, the Bear can be reached at Kuma Computers, 11 York Road, Maidenhead, where I am assured he is longing to elaborate on the other 46 commands that await your BASIC.

APOLLO BAS-MOD costs £17.50 plus VAT.

Tim Moore is 46.

by Julian Allason

Over the top

How are your proclivities? Never mind; the Commodore is about to launch a stupendous new software publishing venture which will take care of them nicely.

To assist the enterprise, advice has been solicited from such well-known software experts as Percy Thrower and Robert Carrier.

The result is some singular new cassettes and cartridges from the house of VICSoft. (You know, I could have sworn I had heard that name before...but no.)

Someone, somewhere *(Slough – Ed)* has put a good deal of thought into getting the whole concept right. The *BBC Mastermind* cartridge for example, features questions set by the TV programme's coordinator, Boswell Taylor (apparently Magnus was sitting on a volcano in Iceland and thus unavailable).

The *Know Your Own Personality* cassette is based on a book by the controversial Professor Eysench, against whom the Militant Tendency are moved to demonstrate on occasion.

The *Robert Carrier Menu Planner* cassette can simultaneously dispose of your culinary problems and the family savings.

You can probably guess what Percy Thrower's angle is.

And that's just the Home Software.

Businessmen are being seriously invited to consider the VIC as a business machine.

Mock not, though. Manufacturers of machines costing four times the price would give their eyes & teeth for software of the calibre of the *VICWRITER* word processor and *SIMPLICALC* forecasting program. Then there is *VICFILE*, for handling information, *VICSTOCK CONTROL* for controlling your stock.

And my dears, the prices. £19.95 on cassette; £24.95 on disk.... At your Commodore dealers now... Oh happy day...

[The Editor would like to apologise to readers for the foregoing, which was composed following a long lunch at the Commodore's expense. It is hoped that Mr. Allason will be fully recovered next month.]

CP/M for idiots

I have a suspicion that Digital Research harbour distinctly mixed feelings about the latest batch of programs 'supporting' their CP/M operating system.

A case in point is *TURNKEY,* described by its publishers, Busisoft (tel: 01-381 4337), as "a program that makes CP/M user friendly."

Regular readers will know that it is the considered editorial opinion of this column that screen messages such as "BDOS error on A:R/O" fall into the same category as press releases about the last program you will ever need to buy, and merit immediate round filing.

TURNKEY replaces CP/M's cryptic syntax with a series of menus listing the courses of action available at any given moment. In place of the error message quoted above you would encounter a short explanation in plain English. In fact it is so straightforward I think I could use it.

All the standard CP/M facilities likely to be accessed by a non-technical user, are preserved. So a typist can List the Directory, Move files from one disk to another, and so on, using the menus.

Hotshot programmers are still able to access the CP/M system directly by typing 'X'. (The Editor also does this in the 'no publicity' box on his pools coupon).

If Digital Research *are* being shifty about *TURNKEY* and its ilk, they are in danger of turning their back on the best chance they have of prolonging CP/M's status as the world's favourite operating system.

It beats me why they didn't incorporate something similar into the latest versions of CP/M. If they had, they might have stood a better chance of fending off the encroachment of Microsoft's MSDOS in the 16-bit market. As it is MSDOS – which Tommy describes as "CP/M after cosmetic surgery" – looks set to steal CP/M's thunder from right under the proboscis of Digital Research.

Flash Corner

For fellow gadget freaks, news of two great new gizmos.

First is Seiko's prototype wristwatch TV, recently demonstrated to my colleague, *Inside Trader*, in Japan.

Seiko's breakthrough – and it has implications for computer people – concerns high resolution liquid crystal display. Their boffins have crammed an astonishing 32,000 pixels into the 30mm screen. That's sufficient resolution for a TV display the size of a watch face.

The use of LCD technology has enabled them to keep the circuit power requirements low enough to be handled by battery.

Seiko's wristwatch TV isn't on sale yet, and indeed they are still working on redirection of the tuner unit. This receives both VHF and UHF signals and slips into the pocket. Connection to the wristwatch display is via a fine cord. There is no speaker but another cord connects to an earpiece. It is due on sale in Japan early next year at about £250.

Gizmo Number Two is my new British Telecom's Automatic Radiophone. Ludicrously expensive, and unadvertised on account of there being a three year waiting list, it works exactly like an ordinary telephone. Except that it is in my car.

Speech is fully duplex, so there is no nonsense about having to say "over" all the time. It also has push button dialling direct from the car without recourse to the operator.

British Telecom permitting, I plan to prepare this column on my portable *Osborne 1* computer and transmit it via a modem link to the radiophone, over the airwaves to the office for typesetting.

So if you see a story datelined 'M4. 110mph' you will know what it means.

If in the meantime you have knowledge of a really amazing gadget that deserves wider disemination, ring me in the car on 0034 – 217422. If there is no answer, it is probably because I am on the other line....

C of E to adopt Space Invaders

The Church of England Working Party on computers is expected to report shortly. Amongst its recommendations will be the widespread adoption of sermon generators to assist overworked clergy, and the introduction of Space Invaders software to boost falling church attendances.

The Working Party, whose report is confidential, have studied the application of computers to pastoral care. Whilst American innovations such as the computerised marriage services performed by the 'Reverend Apple' are rejected as being "too advanced", proposals for the adoption of microcomputers by the clergy are warmly endorsed.

Advances such as the storage of the entire Bible on floppy disk point the way to more effective use of clerical manpower, according to the report. Peter Jones of Compass Designs recently succeeded in storing both Testaments on floppy disks. It is available from 0257-426252.

The provision of games software is recommended as a means of persuading young people to attend services. "We appreciate that some worshippers might object to Space Invaders in church," says Working Party Chairperson, Canon Barry Biddles. "However, arrangements can be made to turn the sound down during services."

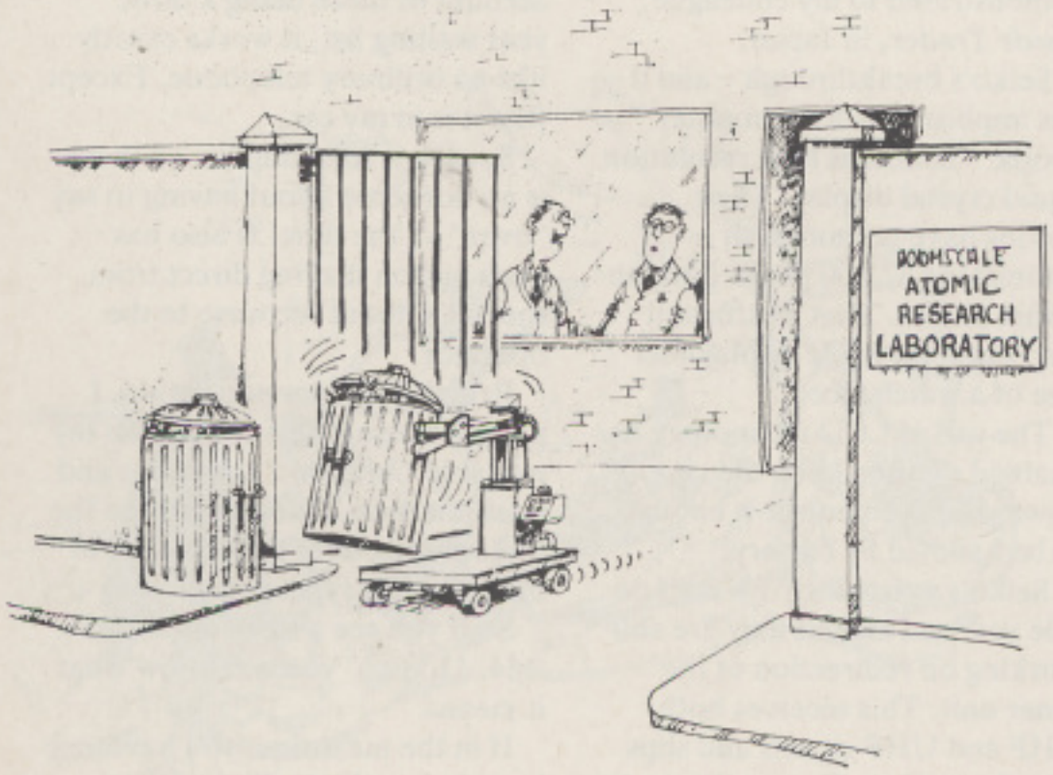
The Working Party also report favourably on the model 88 and 996 printers from Russet Instruments Ltd. of Nimrod Industrial Estate, Reading (tel: 0734-868147). These have been enhanced to print in Old English text:

offer an unlimited number of character fonts to be printed including Text, OLD ENGLISH, shadow in either single or double height.

The report adopts a cautious attitude to the question of the eventual replacement of the clergy by computers. "Whilst the systems we have examined perform many of the functions of the priest perfectly adequately, we believe that it will be some time before computers replace the clergy entirely," says Canon Biddle.

"Technically, this is perfectly feasible. The obstacle we have to overcome is opposition of conservative elements in the Church hierarchy."

Archbishop Runcie was unavailable for comment.



'Thanks to computers we don't have to manhandle radioactive waste at all now.'

And now the VisiCalc machine

You plug it in, turn it on and there is VisiCalc, or something as close as makes no difference. No loading. No waiting. It is there.

Graham Tuppen and John Barford are not the sort of people you would have expected to find creating a novel computer system. Graham's an accountant, John a businessman.

Yet their new micro, the *Prophet II* (no, I don't know whether there was ever a *I*) is thirty times more interesting than most of the Z80A, 64K RAM me-too computers surfacing daily.

For one thing it's cheap – £795 + VAT – by business standards at least. Add their printer and you are still under £1,000, the magic figure below which many junior executives can authorise purchases, according to Tuppen.

The hardware is in fact based on the Acorn Atom, although Messrs, Tuppen & Barford aren't advertising this fact; it has been heavily modified, apparently.

What I like about *Prophet II* is that it doesn't even try to be a general purpose computer. It is for financial modelling. As a high proportion of microcomputers sold into the business market are used for nothing else, this makes sense.

The plan is to build up a library of standard models to be sold as *Busitapes* for between £10 and £25. So if you are in heating engineering and need to work out radiator sizes, you get the heat engineering model; if you are into leather you get .. *(That's quite enough of that – Ed).*

The *Prophet* is being sold in an unusual way too – through a network of franchisees, all of them ex-businessmen rather than computer people.

Frankly, we would rather not be a guinea pig for some businessman turned novice retailer. Our advice would be to ask Messrs. Tuppen and Barford for the name of an experienced dealer handling the *Prophet*.

You can do so by ringing Busicomputers Ltd. on 0832-72052. Ask them whether they will lend you one of their 'Talk-you-Down' tapes. It is their way round the Catch 22 problem of not being able to understand a computer without using it, and not being able to use it without understanding the procedures.

Clever idea really.

Stupid boy

Yes, this column can be numbered amongst the many who tried to understand Calculus and failed miserably.

In those distant days the Calculex IV program wasn't around. Nor, come to think of it, was the 16K ZX-81 needed to run it – which proves how ancient this column is.

The program contains more than 50 pairs of Differential/ Integration formulæ which you can look up and use directly in the calculation. Once you have found the general formula matching the equation you want to integrate or differentiate, you input the values for the coefficients and the program does the rest.

£12 to Calculex at 21 Headland Avenue, Seaford, East Sussex and you too could be an expert on Calculus.

by Julian Allason

British Imperialism

British Micro. Ah yes. I can see it all now ... The Union Jack proudly flying over their headquarters at *Imperial* Way, Watford ... Colonial types taking tea on the lawn ... The sun never sets ... Land of Hope and Glory ... Dringg. Dringg.

What? Oh, the telephone.

Who? Manas Hegoyan, you say, of British Micro? Can you interest me in a what?

A *Mimi 802*. Are you sure? Well, it doesn't *sound* very British...

Not you; I meant the computer ... No. Mimi sound sort of German to me. Or American maybe. Japanese? ... Yes, well, I quite understand that it is too late to rename it now. Perhaps you can tell me something about it them.

£1350 + VAT. Yes, got that. Based on Z80A chip, you say. I suppose you will be telling me that's as fast as one of these new 16-bit chips ... Oh it is, is it? 4MHz. Yes. Well, I'll take your word for it. What else?

64K of RAM. Good. Build-in floppy disks. No, 700K doesn't sound too bad. Full RS232C and Centronics ports too. Pretty well standard nowadays, no?

Oh, you don't think so? I certainly wasn't being sarcastic, and I am sure your forthcoming Winchester disks will indeed take care of any problems in that area ... I say, would you mind awfully not calling me 'Squire'?

Yes, of course I am taking this seriously. What about the operating system, then?

CP/M compatible. Sounds good ... An amazing software breakthrough, you say?

Well, I'm sure you are right. High resolution graphics too? Sounds good for £1350. Oh, the hi-res graphics are an extra £145? And another £132 for the monitor. Plus VAT. Got that.

What do I think of it?

Well, Mr Hegoyan, you will appreciate I haven't actually used it, but it does sound quite competitive ...

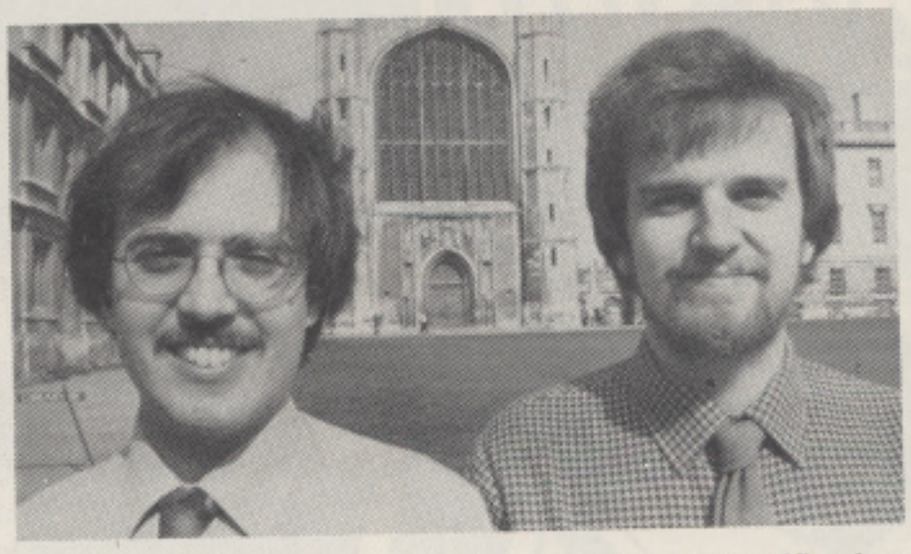
No, not defective – competitive. We must have a bad line.

Well, since you ask, there is one thing. It doesn't sound very, um, very British ... Hello? Hello?

[Editor's note: As usual, our ace reporter forgot to ask the key question, in this case about TROJAN, the intriguing new operating system-cum-language-cum-program generator for the MIMI. The theory is that TROJAN enables even novices to communicate conversationally with the computer via keyboard and screen. This isn't the first time sweeping claims have been made for program generators. If TROJAN works as described, it will be big news, so watch this space.

One more cock up, Allason, and you're fired.]

Boffin Bashing & a new micro



Teenage Boffins Vickers & Altwasser

It is some three years since I enjoyed a splendidly public row with someone called Cluff from the Institute of Data Processing Management.

Mr Cluff's view, if I remember it aright, was that micros were an abomination; would be the ruination of every small business that installed them; computing to be left to the professionals etc. etc.

The press had some fun with all this, especially when Mr. Cluff was subsequently alleged to have admitted on a radio program that he had never been into a micro computer shop, let alone used one.

There was also the uncharitable suggestion that the Data Processing Managers, for whom Cluff apparently spoke, might just have had the teeniest vested interest in keeping the punters away from the machinery.

Loath though I would have been to admit it at the time, there was a good deal of justification for the Institute's Canute-like stance. Plenty of microcomputers weren't – and still aren't – properly supported. Plenty of small businesses have undergone the most painful experiences installing micros *(as depicted by Paul Sample on this month's cover)*.

Nonetheless the brutes are here to stay, and getting easier to use all the time.

This point was underlined by the recent arrival of the *Jupiter Ace*.

Now you may think that this £89.95 computer bears a more than passing resemblance to another low-cost micro. And you would be entirely correct.

Its creators, 25 year-old Richard Altwasser and 29 year-old Steve Vickers, are both ex-Sinclair men; the latter author of the ZX-81 manual and most of the *Spectrum's* ROM; the former says he was in charge of hardware research on the same project.

What's interesting about their computer is that it is designed to avoid floppy disk back-up, and its native language isn't BASIC.

It is, in fact, FORTH, a fast compiled language for which you can virtually write your own syntax.

Imagine being able to create your own computer language almost from scratch: with FORTH you do just that by giving each compiled routine a name or FORTH word. By stringing old words together you can define new ones, and indeed a tailormade language of your own.

FORTH was originally developed for Astronomical use, and enjoys what is perhaps best described as a cult following. In my software-flogging, Cluff-bating days, we offered the first FORTH implementation on a micro; it was not, I am sorry to say, an overwhelming success.

Perhaps Messrs. Vickers, and Altwasser (tel.0954-80437) can change all that with their Jupiter Ace.

I wish ' em luck.

IF THE CLOUDHOPPERS, WASPS, SPIDERS, METEORS, OR SATELLITES DON'T BEAT YOU...

...RENAISSANCE WILL

CLOUDBURST
meteor run
Renaissance
SPIDERS OF MARS
satellites and meteorites

5 More great VIC Cartridge games from Audiogenic

Available from all VIC dealers or direct from Audiogenic Ltd. PO Box 88, Reading, Berks. (0734 586334) Credit cards accepted. Meteor Run, Renaissance, Spiders of Mars, Satellites and Meteorites £24.99, Cloudburst: £49.99 (inclusive of VAT and p&p). All titles copyright UMI INC represented in Europe by Audiogenic. Send for full catalogue.

by Julian Allason

Great Olivetti Mystery

The standard survey by which the computer industry measures itself is conducted by an outfit called BIS-Pedder.

According to these gentlemen the market leader in low cost systems is Apple – with Commodore in second place. Even more surprising is that BIS-Pedder place Olivetti third.

All of which may have come as something of a surprise to you, and readers of *Computing* and the *Observer* who reprinted our own survey. That, you will recall, placed Commodore in first position, followed by Sinclair, ACT Sirius, Acorn/BBC and then Apple. Olivetti didn't actually make our top ten at all.

Pedder's figures were apparently based on the sales claimed by manufacturers for 1981. Ours were bang up to date. But this only explains part of the anomoly.

In a fearless bid to uncover the truth I called Olivetti, where a charming lady called Margaret Mason gave me all sorts of useful information about their 16-bit M20 micro computer launched in July. More on this in a moment.

Olivetti's sales remain something of a mystery since the company will divulge only that it is "aiming for 8% of the market."

Aha! What value did they put on the market, then?

A strangled cry from Ms. Mason. Then a long silence, followed by the news that such information was top secret.

Subsequent enquiries through the trade suggest that Olivetti are currently selling about 200 M20s a month. On which basis the company still wouldn't make our Top Ten.

However, that could change, as the M20 looks to be a well engineered, well designed machine. Certainly our hard-to-please Editor was impressed.

Characteristically Olivetti have gone their own route, choosing to use a microprocessor, the Z8001, hitherto conspicuous by its absence from most well-known makers of micros.

They designed their own operating system too. It is called PCOS, and although Microsoft BASIC is supported, it is otherwise distressingly incompatible with everything else. The effect of this will undoubtedly be to limit the choice of applications software available.

Olivetti see this a little differently, appearing to reason that it will mean less competition for their own business packages, when they become available. A dozen independent software houses have also been commissioned or encouraged to support the system.

£2395 buys an M20 with 160K of RAM and 572K bytes of integral floppy disk storage. That 160K of RAM looks rather less impressive once the PCOS operating system has been loaded: it takes up an astonishing 100K bytes.

No matter, many businessmen will opt for Olivetti; for the same reason they buy IBM – the security of a big name. And when it is your business at stake, why not?

Dragon to save Corgi?

Can the Dragon save the Corgi? With British toy manufacturers falling like ninepins, it's good to see Mettoy, manufacturers of Corgi toys, easing themselves discreetly into the 1980s.

The mechanism by which this elevation is being achieved is not via their bootstraps, but a new British-built – correction, Welsh-built – micro called the *Dragon*.

And it had better work. Mettoy lost £2.56 million pre-tax last year and £3m the year before.

On the face of it they do look to have got it right, however. By right, I mean that they have observed the two cardinal rules of micro marketing. These state that for a new product to succeed it must offer a significant price and performance advantage over the competition, and must be extensively advertised.

The £199 Dragon offers twice as much RAM – 32K – as similarly priced systems like the Atari 400, Texas Instruments TI99/4A, and six times as much as the Commodore VIC-20.

It has a proper typewriter keyboard, reasonable colour graphics and sound, and some innovative software.

The Dragon is based on the 6809E microprocessor, a sort of souped-up 6502 (the chip used in the Atari, VIC and Apple). Its 32K of RAM memory can be expanded to 64K. Plug it into your TV for nine colour display of 16 rows of 32 characters to high resolution of 256 x 192 points. Point by point drawing, lines, arcs, circles and painting of solid areas are all possible using the High Level Extended Colour BASIC.

Sound in the form of five octaves, 255 tones, 155 tempos and 31 volume levels is delivered via the TV speaker.

Software, of which a limited amount is already on sale, comes in the form of plug-in games cartridges and cassettes.

The Dragon people describe as 'innovative' their practice of supplying cassette software written in unprotected (against copying) BASIC. This may perhaps come as news to other software publishers, most of whose output continues to be in unprotected BASIC. Dragon however say they don't object to *their* cassette games being copied.

There are some nice Toolkit-type commands in the BASIC, including a search command that will locate specific words or phrases, line renumbering and a TRACE feature that simplifies program debugging.

A disk operating system, RS232 port and 2nd processor (!) are promised for next year.

One beef: despite the cunning photography the top of the computer isn't big enough to stand a TV monitor on, Apple fashion.

All in all quite a nice system that looks like good value for money. Whether it can save my son's beloved Corgi toys from the knackers yard, remains to be seen. Here's hoping though.

Stop Press: Digital Research invents screen editing

What were you doing in 1978? Me, I was learning to program my brand new PET, serial number 000008.

One typed in a line such as:

```
100 INPUT"WHAT IS YOUR
                NAM";N$
```

Then it dawned that an E had been omitted from NAME. So one used the *cursor up* and *cursor right* key to move the little flasher along to the second quotation mark, held down *shift* and pressed the *INST* key, followed by an E and *Return*.

It came as a considerable shock to me to learn that the same exercise on a computer running the CP/M operating system, involved a prolonged wrestle with the manual. Followed by much hammering of the *Control* key, further reference to the manual to remind oneself which key doubled as insert when *control* was held down, and so on. And on. And on, until one was used to it.

Plenty of other systems required you to retype the whole line. Or at the very least, to move the cursor right along the old line from the beginning, before making the correction. With the PET you just cursored to the error from any point on the screen.

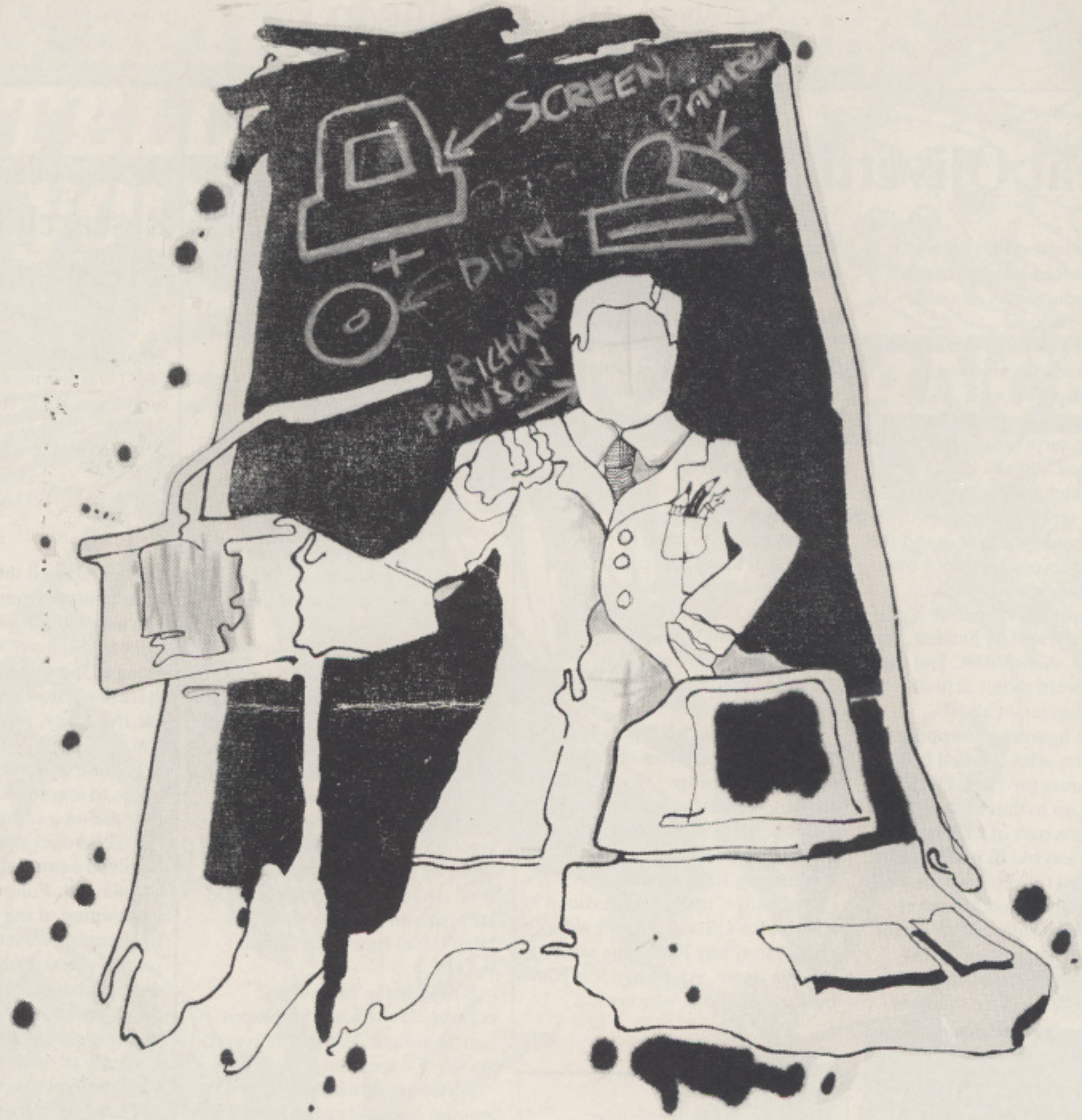
In short it took Dumbo here two years to realise that Microsoft and Chuck Peddle had between them created a superb screen editor for the PET.

What makes me feel better about the timescale involved in making this discovery is that it seems to have taken Microsoft's arch rivals, Digital Research twice as long.

At any rate they have only just launched *Display Manager*. The program, which is described as allowing you to "interactively design displays faster than ever before" supports most CRT attributes; that's to say, flashing cursor, reverse field (black on white letters instead of white on black), and the like.

What is quite clever is that it not only adapts itself automatically to the CRT being used, but also works with Digital Research's full range of commercial programming languages. That means Pascal/MT+, PLI/80 and the CBASIC compiler.

Ah well, better late than never.



WHAT MAKES UP A COMPUTER ?

Continuing our series for absolute beginners that answers the questions you never dared to ask, **Richard Pawson** looks at the different devices which make up a microcomputer system and what each one does.

Last month we learned that a computer is really a **processor** of information, and that a **program** is nothing more than a long list of simple instructions, which together tell the computer how to perform the application you want.

A computer **system** will typically be made up from several different parts, each with a specific role to play in the processing of information. A home computer, for example, will at least have a **keyboard** and a **screen**, while a full business micro will most likely run to **disk drives** and a **printer** as well. The function of these is explained fully in this article.

For most business applications, the list of devices you will need is determined by the particular applications programs you want to run. Sometimes there are options, where, for example, having a printer will let you get more from the program, but isn't essential to make it work.

For home use, most people start with the minimum system and add extra parts as their budget permits or requirements demand. Devices which can be added on to a computer and are usually separate from the main casing are called **peripherals**. In between pure home and business users there is a large group of people who do a little of both applications. In these circumstances, a home computer can often be upgraded to business status simply by adding the right peripherals.

How many boxes?

Sometimes a computer will have most of its component devices (such as keyboard, screen, central processor, disk drives and [rarely] printer) in one box. This is called an **integrated** design, and has the advantage that it occupies less desktop space and has fewer unsightly connecting cables between devices. Some manufacturers claim this to be more reliable from an engineering viewpoint, though there is little evidence to support this.

The newer breed of business micros are tending to move the other way with freestanding keyboards and screens. This does permit better "ergonomic" design (see feature on "Good Design" last issue) and enables executives to key in information with the keyboard on their knees (see photo)! Separate units, say those with a vested interest, make for faster servicing, though again this depends far more on the quality of service offered by your dealer than on the hardware design.

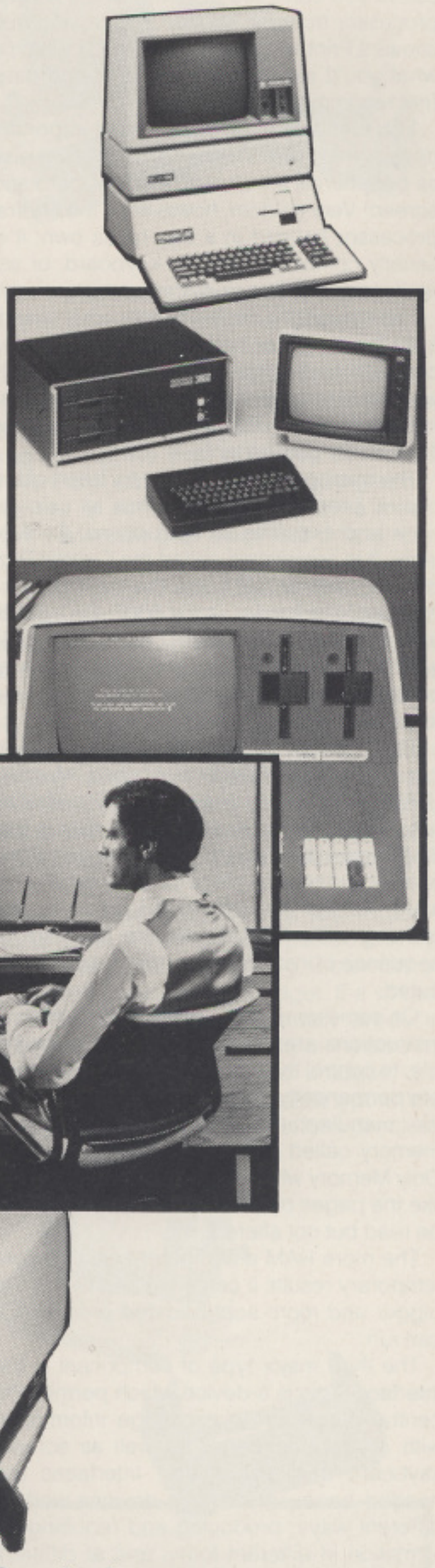
Most home computers have gone for the 'separate units' approach in the interests of manufacturing economy. The results, however, can look particularly messy when laid out on the coffee table: keyboard/computer, mains transformer, cassette recorder, joysticks and T.V. interface, all connected together, spaghetti-fashion.

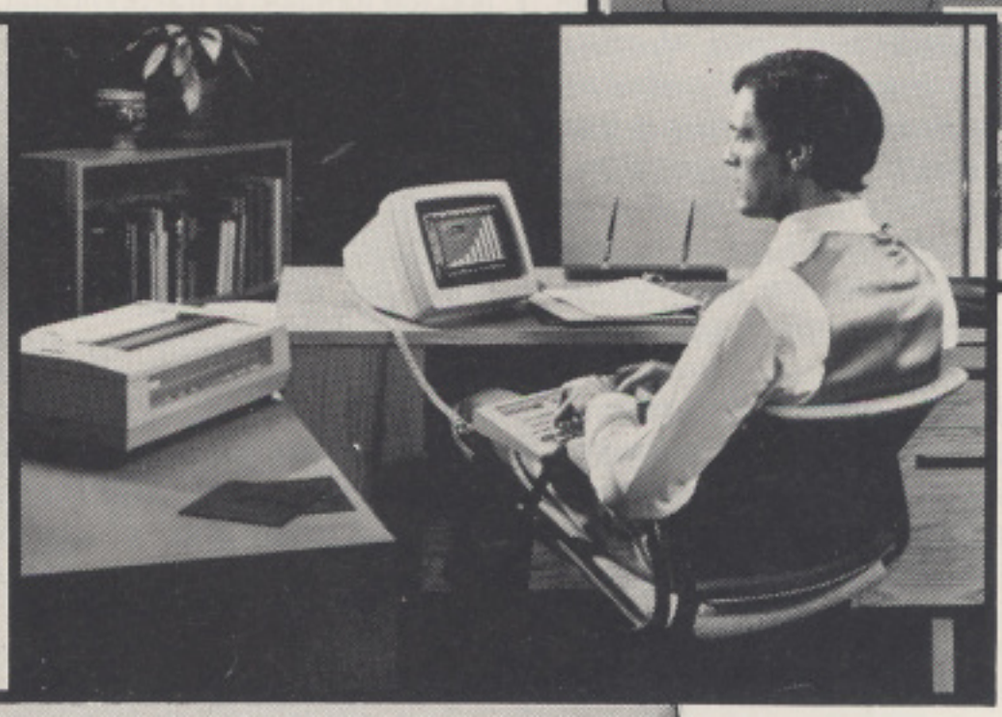
Options

The traditional arguments associated with music centres vs. separate hifi units do not apply to computers. To wit: buying a 'units' computer does not permit you to pick and choose from different manufacturers to get the best value, because you are usually restricted to one make for compatibility. You may be offered a number of options (such as screen size and disk capacity) by the manufacturer but this applies to both types of machine. The exception is the printer: most computers will work with most printers, which is just as well since many computer firms don't make their own printers.

Overleaf you will find our quick run down on the major components of a computer system. The list is by no means exhaustive, and elsewhere in this month's issue you will find an article detailing a number of alternatives to using a keyboard for inputting text. This even includes joysticks for use with games, and devices that can read handwriting! Equally, there are alternative ways of producing output: graph plotters, Braille machines and speech synthesisers! We haven't gone into these here because they are only used for specialist applications.

The Apple III, RM380Z and SuperBrain (from top) all offer different approaches to physical design.





Integrated design (above) makes for a neater desktop, though separate units do provide flexibility (above right). The portable Osborne (right) is a unique solution.

Conclusions

A computer system is, thus, made up from several component devices – each of which has a specific role to play in the processing of information. Sometimes a computer can be bought in a minimum form and later expanded with peripherals to give it more power and flexibility. Most business applications, however, demand a full system from the outset in order to run the program.

Over the next couple of issues we shall be looking at what a computer can do for *you*, what level of system you ought to be thinking about, and how to read a specification sheet. ▶

The central processor

This is the main part of the computer – responsible for the actual processing. Because you can't see anything of the central processor from the outside, the photograph shows a Printed Circuit Board (PCB), which is what you'd see if you opened up the case (not recommended!)

Because this is by far the most important device, many boffins refer to *everything* else as peripherals – including the keyboard and screen! Very seldom, however, is the central processor housed in a box on its own; it is usually combined with the keyboard, or screen, or disk drives or all three.

The design of a central processor is essentially the same for both home and business computers, though the latter can usually work faster and process more pieces of information at once. The PCB usually contains three major components:-

The **microprocessor** is the very heart of the central processor and performs all calculations and executes all instructions. Confusingly, it is sometimes called the Central Processing Unit, or CPU, and the most popular "models" are known as the 6502, Z80, 8088, etc. However, a microprocessor can only work with a minute piece of information at once (say, one digit) and needs somewhere to store temporary results.

This is called **memory.** The most common type is called Random Access Memory (**RAM**), which really doesn't describe what its function is. All you need to remember is that RAM works like a scratchpad – you can store, alter or erase any piece of information you want. As well as holding the data you are working with, RAM stores the program or sequence of instructions currently being executed.

On some computers, certain sequences of instructions are used all the time (for example, to control the colours and sound) so they are permanently 'burnt in' to the computer by the manufacturer, using another type of memory called **ROM.** This stands for Read Only Memory which is very descriptive since, like the pages of a book, the information can be read but not altered.

The more RAM a computer has, the more temporary results it can store and hence the bigger and more sophisticated programs it can run.

The third major type of component is the **interface.** This is a device which permits the central processor to exchange information with all the peripherals as well as screen, keyboard and disk drives. Interfaces are needed because all these devices work in different ways, producing and requiring information in different forms and at different speeds. All the interfaces do is handle conversions between them.

The central processor is often described as being **transparent**, because you can't physically see it, and as a user, are not aware of what it is doing. You certainly don't need to know *anything* about CPUs, RAM, ROM and interfaces to operate a computer. Reassuring, isn't it?

The keyboard

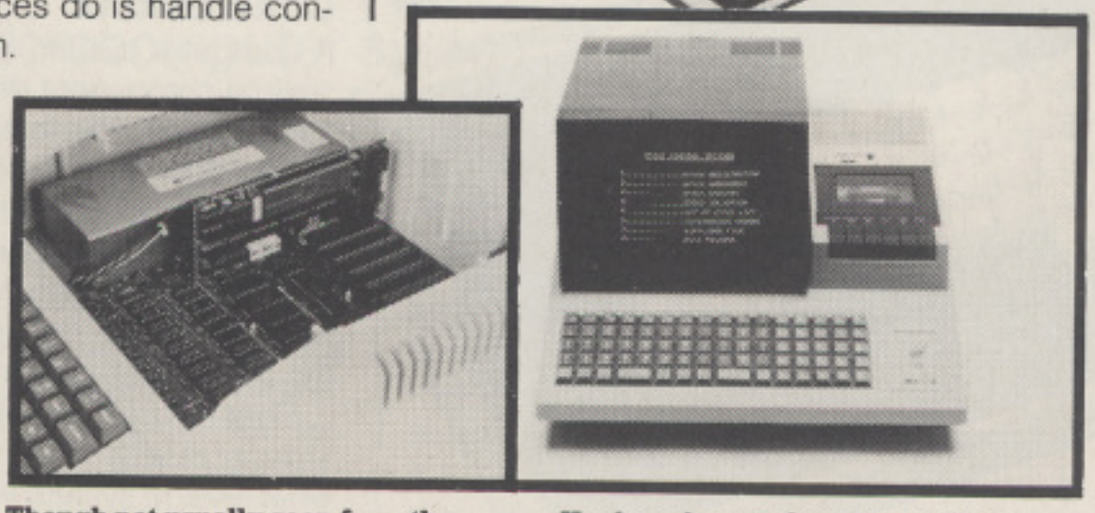
This is an easy part of the computer to understand. The **keyboard** is the means by which you talk to the computer. Mostly this is to give the computer the information you want it to work with: a name and address, number or scientific measurement, for example. Also, this is where you **command** the computer: tell it which of a number of options to execute. Commands can be anything from 'cancel this invoice' to 'shoot at the spaceship' and may need to be typed out in fully, or simply represented by a single key press.

The main part of any keyboard is just like a typewriter, with the alphabet in QWERTY layout plus punctuation. Some machines have the numbers (0-9) arranged in a **numeric keypad**, like a calculator, which is faster when typing in a lot of figures.

In addition, there will be a number of keys not found on a typewriter – used for controlling the function of the computer.

A particularly useful feature being incorporated into new computers is **programmable function keys** (usually labelled F1 to F10, or similar). These can be defined from within a program to mean whatever you require. This is a good example of **user-friendliness** – the computer adapting itself to your requirements, not vice versa!

As on a typewriter, the quality of the keyboard varies with price; the more expensive units having a better 'feel' and moulded to suit a touch typist. Other considerations include the height and slope of the keyboard. Home computers are not generally used for typing in large amounts of text or figures, and don't need typewriter quality keyboards. Indeed, some home computers have 'touch sensitive' or solid-state keyboards, which are cheap to make but not so easy to use.



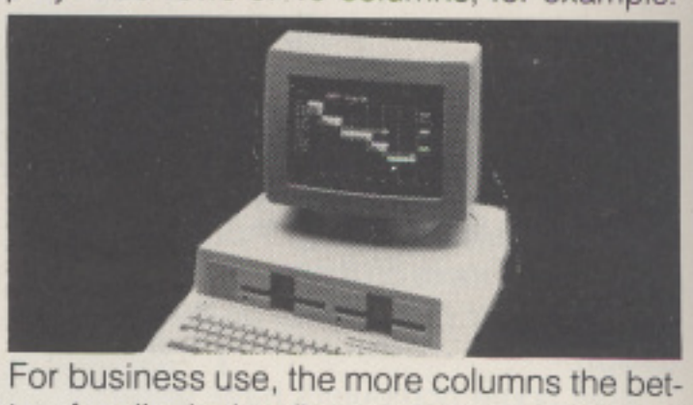
Keyboards vary from typewriter quality through to solid state.

Though not usually seen from the outside of the computer, the central processor does most of the work.

The screen

If the keyboard is where you talk to the computer, then the **screen** is where it talks to you – displaying results, instructions and hints to the user as well as questions to which it requires answers. Cartoons frequently depict the screen as the face of the computer because that is where it expresses itself.

Most information is displayed in the form of **characters** (A-Z, 0-9 and punctuation), so the *size* of the screen is generally specified in terms of the number of characters it can display – 25 rows of 40 columns, for example.



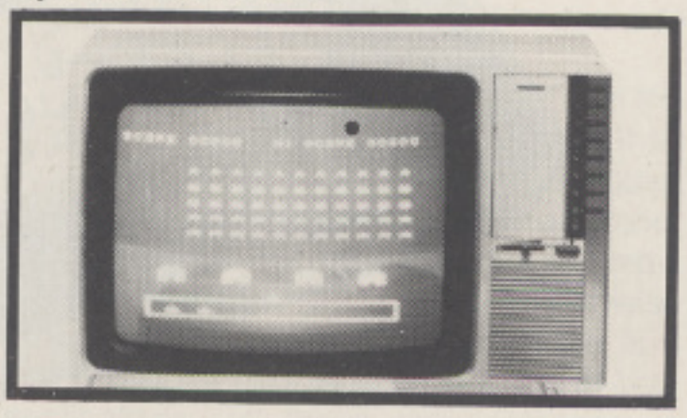
For business use, the more columns the better, for displaying financial results or the full width of a typed letter.

Different parts of the screen can often be made to stand out with the aid of underlining, flashing results, and **reversed field** (which produces black characters on a white background rather than the other way around). In addition most computers now offer graphical displays in one form or another. This can vary from the ability to generate colourful, fast-moving objects for video games, to rather staid bar graphs and pie charts to illustrate manufacturing and marketing trends.

Which brings us to one major difference between computers designed primarily for the home, and those for business use. Most in the former category have now done away with the built-in screen, in favour of interfacing to a domestic T.V. set. This saves the cost of a major component as well as providing colour and a loudspeaker for sound generation, in some cases. It does make the computer less portable, though.

On a business system, more money buys you a better quality screen, both in terms of size and clarity of the characters, and graphic possibilities. The most modern designs can be adjusted for brightness, contrast and angle of view. The colour of the ideal monochrome screen is frequently debated and argued over by designers, but green, yellow, brown and white, on a black background are all now possible.

Note: we have deliberately avoided the use of the term VDU (Visual Display Unit) in this article because it is ambiguous. Some companies use 'VDU' in place of 'screen', while others use it to mean 'computer terminal', i.e. keyboard and screen!



Though business computers can have adjustable high quality screens built-in (top), most home computers interface to domestic T.V. sets (bottom).

Cassette recorders

When microcomputers first appeared on the scene, they all had interfaces to a **cassette recorder** – either an ordinary domestic unit, or one modified by the computer manufacturer to provide a slightly higher performance, and excuse for a disproportionately higher price! With the advent of the floppy disk drive, however, cassette recorders are now used almost exclusively by home computers.

In brief, the cassette recorder is used to remember information when the computer is switched off, because RAM memory always loses its contents when the power is removed. Though pure data can be stored on cassette (such as the current positions of a chess game, or the details of your household budget), for most home applications, it is the program that needs to be saved.

After all, it wouldn't be much fun if every time you wanted to play Space Invaders you had to key in the several hundred lines of complex code which constitute the program! Using a cassette recorder means that the program can be loaded into RAM in a couple of minutes or less.

Most commercial games and home utility programs are consequently sold already recorded onto cassettes. This does, however, make it relatively easy to make illicit copies for distribution to friends! Software Piracy, as it is known, is one of the major problems facing the microcomputer industry, and software distributors are constantly looking for ways to protect their products.

One solution is to distribute programs in the form of solid-state cartridges, similar in size to cassettes, which plug into the computer and hence take no time to load. These are more expensive to make because they in fact contain ROM memory, but are much harder to reproduce illicitly.

Loading a program from cassette involves typing a simple instruction on the keyboard, pressing the 'PLAY' button on the cassette recorder and waiting. The computer transfers a copy of the cassette's contents into its RAM memory, and when finished, the cassette may be removed – leaving the program to run entirely within the central processor.

Cassette recorders, whether built-in or external, use the same mechanics as audio units.

Disk drives

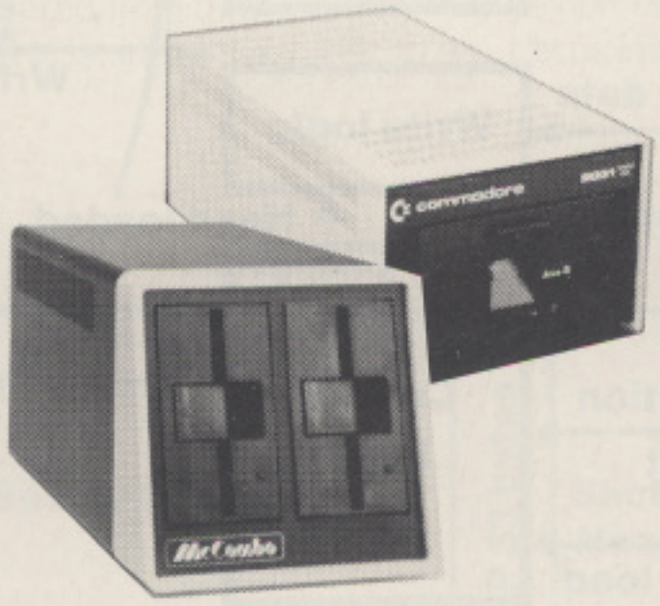
Put in one sentence, the reason why business computers need **floppy disk drives**, where home computers can get away with a cassette recorder, is that most business applications work with far more information than can possibly be held in the central processor's RAM memory at any one time. Business programs work by finding the pieces of information required on the disk, loading them into RAM and then performing the processing. If alterations have been made to any of the data, then the results are stored back onto the disk. Like cassettes, disks do not lose their contents when the power is turned off.

The reason why a cassette unit won't suffice for this function is that it would be too slow to be practical. To find a particular customer's name at random, it may be necessary to read through the whole tape – say one hour at worst. The design of a disk system means that you can jump to any piece of information in about one second and then load it into RAM. Incidentally, the more RAM you have, the less to-ing and fro-ing from disk is involved, which speeds things up even more. However, as a general rule, RAM is far more expensive than disk per unit of information.

So what is a floppy disk? If you want a full explanation, see Chris Preston's 'How it Works' this month, but for the impatient and, er, not-so-clever, here's a brief outline. A floppy disk is a flexible, circular piece of magnetic material, usually 5" in diameter, which can rotate inside a square envelope. This protects the surfaces from dust and fingermarks. The floppy disk is then inserted into a **floppy disk drive**, which is essentially the mechanism for rotating the disk and transferring information between the magnetic surface and the computer.

Most business systems have two such disk drives mounted in one unit, so that information can be copied from one disk surface to the other. This enables "back-up" copies of vital information to be made, both for security purposes and in case the computer should malfunction and destroy information.

Some expensive business computers use "hard disks" which, as the name suggests, are rigid instead of flexible. These can store more information and work faster than 'floppies' but cost more. It is more difficult to make 'back-ups' because usually only one drive is used, and the disk itself can't be removed.



Twin disk drives are a feature of most business systems. A few manufacturers offer single drives for those with low budgets.

The printer

While the **screen** can be used to display any results, stored information or commands, a **printer** is required if you want a permanent copy (sometimes called **hard copy**). More or less anything that can be shown on a screen can be printed out on a printer – provided the program permits that, of course. However, printers that can reproduce quality graphic displays or even colour, tend to be much more expensive than those that deal simply with text.

So why do you need permanent copies? After all, with all this talk about the 'electronic paperless office', printed material could become a thing of the past! There are, in fact, two main uses: first, to interface the computer with the existing manual system, and second, to provide reference material when working away from the computer screen. This includes everything from aged debtors lists and invoices in business, to a hard copy of the program listing you are developing at home.

Selecting the right printer for your requirements is one of the trickiest aspects of buying a computer. Broadly speaking, it consists of a trade-off between your budget, the speed at which the printer can actually produce documents, and the readability of the results! The most expensive models produce text which looks every bit as good as a typewriter, whilst text from the cheapest can result in severe eyestrain!

Printers vary considerably in both speed and legibility of printed output. Those which offer graphics or colour, cost more.

HOW IT WORKS

HARDWARE

A well-designed floppy disk system should be 'transparent' in operation – the user does not need to know how it works internally to use it. But this can only be achieved using both sophisticated hardware and software as **Chris Preston** explains.

The floppy disk drive has been available, in one form or another, for quite a few years now, but many enthusiasts (and quite a few professionals too!) still have no more than a very hazy idea how one works. The principle of operation is quite simple, however. This is a simplified block diagram of a floppy disk system.

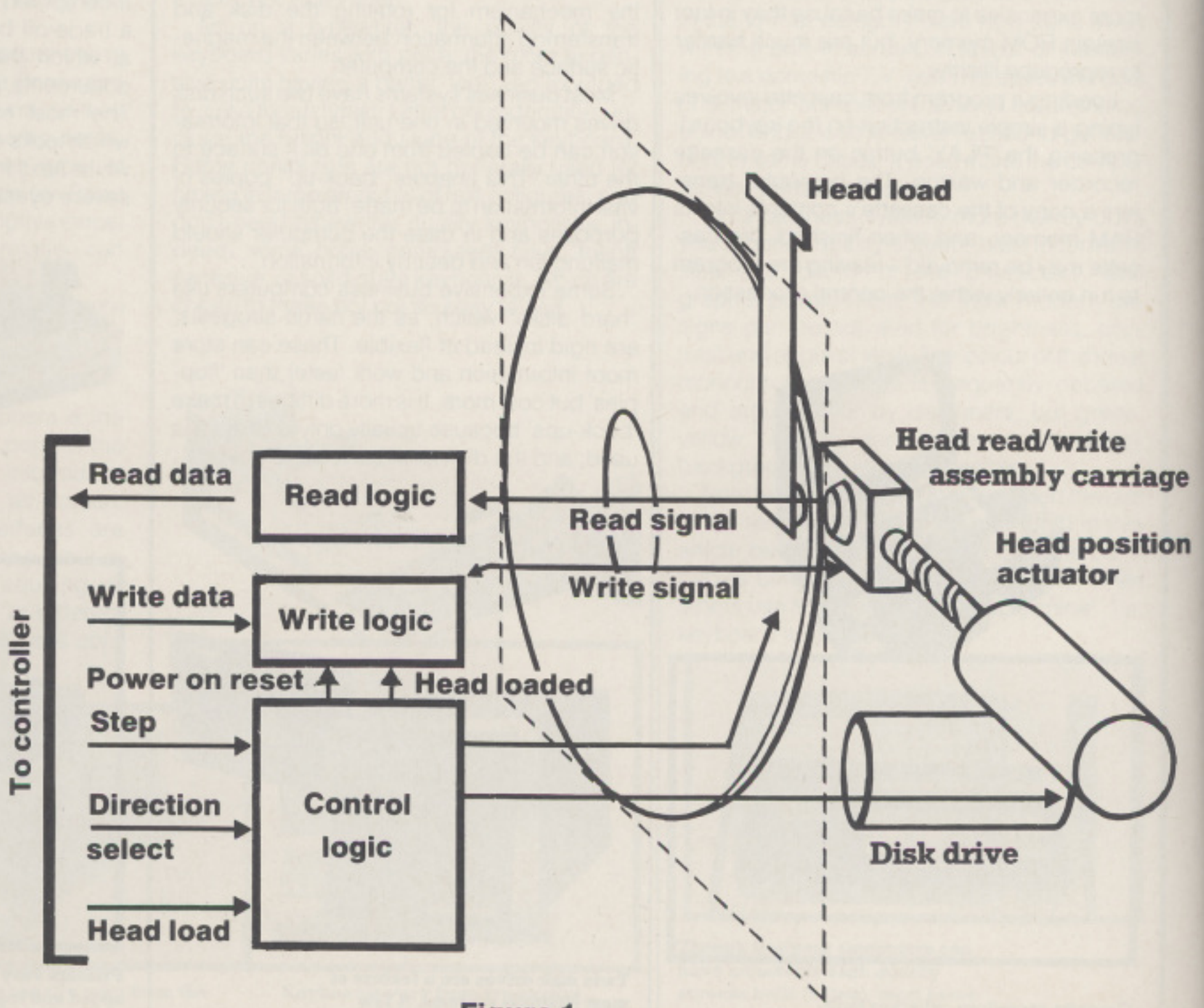


Figure 1

T WORKS

The computer may be in the same case as the disk, or may be in a separate box connected to the disk drive by a cable. In some machines, the same processor is used to control the disk drives as run your applications software. In others, the disk unit has its own computer called the disk controller, solely to manage disk functions.

The disk itself consists of a thin piece of plastic, coated with a magnetic material similar to that used for tapes. It revolves inside a square protective sheath, with a slot cut in to expose part of the disk itself. The information is carried to and from the disk by means of a *head*, which works in the same way as the head on a tape recorder. The disk drive contains electronics to convert information from the form provided by the host computer to that required by the head.

A slightly more complex system records data on both sides of the floppy disk, using two separate heads. We will only talk about single-sided recording here, because it makes the diagrams a little bit easier to read if there is only one of everything. One word of warning to people who think they can double the capacity of their disk drives by turning the disk upside down and recording on the back. DON'T! Firstly, ordinary single-sided floppy disks are not reliable on the "other" side. Secondly, even if you use proper double-sided disks, you may get into trouble. The disk is meant to rotate in a certain direction only, and the inside of the protective sleeve is designed to pick up any dust or grit on the surface of the disk. If the disk rotates the wrong way, the lining is "brushed the wrong way", and all the dust comes pouring out, which can scratch the surface of the disk quite badly. The disk may survive for some time, but eventually – much sooner than it should – it will give up the ghost.

First we will look at the way the information is recorded on the disk. The data is recorded on a number of circular "tracks", each track being divided into a number of sectors. This contrasts with an LP record, where the information is recorded in a single spiral groove which runs to the centre from the edge of the record. The tracks are numbered from 0 (at the outside of the disk); the sectors from 1. This is one of the funny conventions which crop up from time to time in the computer industry (other funny conventions include The PET Show, but we won't go into that here).

At the start of each sector is a header, which tells the disk controller which track and sector it is reading. This information is used purely by the disk controller, and is not sent to the host computer. The header is followed by the sector data itself, which contains the data sent by the computer. At the end of the sector data is *Cyclic Redundancy Check* field, normally two bytes long. This is calculated by a special chip from the data recorded on the sector using a rather complicated formula. When the sector is read back, the CRC is recalculated and compared with that written on the disk. If the two values are different, then an error has occurred. The disk controller will now try again to read the sector, and will normally try between 3 and 15 times to get the data from the disk correctly before giving up and sending a "DISK ERROR" message to the computer. Most people would be horrified if they knew how many "soft errors" occur, that is errors which disappear when the faulty operation is repeated. Fortunately for our peace of mind, our computers only tell us about the "hard errors", those which really are permanent.

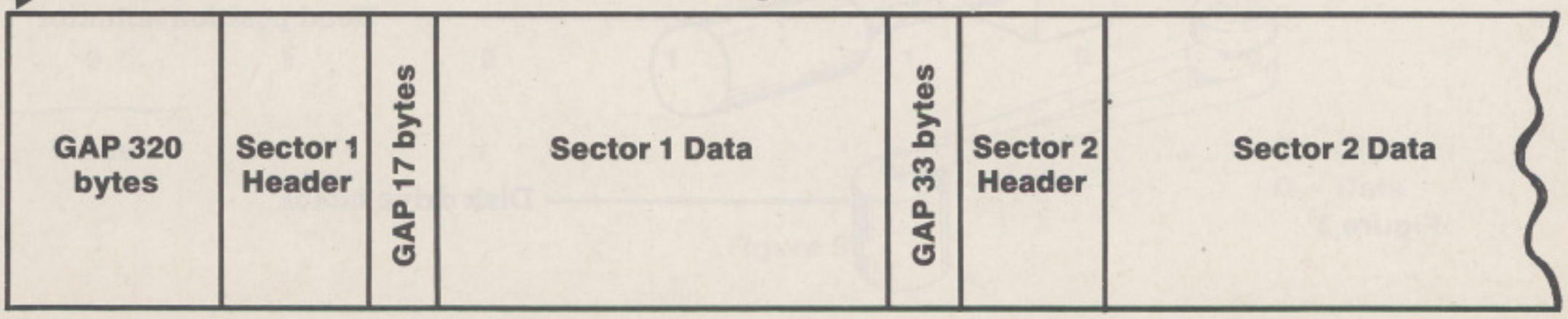
The sectors on the disk do not all run together: they are separated by gaps. This is to allow for the fact that the motor which spins the disk does not run at a constant speed. If the motor is running a bit fast one day, or the disk is being used on another disk drive, which runs faster than the one it was first recorded on, then each sector will occupy that little bit extra on the track, and if it were not for the gaps, it would overwrite the next sector. The gaps are fairly short, 20 or 30 bytes each, but are essential for safe recording.

Sector Numbers

Another little known fact is that the sectors are not necessarily numbered 1, 2, 3 etc. round the track. Say we have 20 sectors on a track. Depending upon the speed of the host computer, they may be numbered 1, 11, 2, 12, 3, 13, etc., or 1, 6, 12, 18, 4, 10 etc. Let us imagine that the computer wants to write two ▶

Start of track

Figure 2



HARDWARE

HOW IT WORKS

sectors consecutively, and they are numbered 1, 2, 3 etc. After writing sector 1, the computer has to wait one complete revolution of the disk until sector 2 comes round; if the tracks are numbered 1, 6, 12 ... then it only has to write for a much shorter amount of time. If the tracks are numbered 1, 11, 2, 12 ..., then sector 2 may come round before the computer is ready for it, so even more time will be wasted. By choosing the correct sequence, the speed at which the computer can read and write data to the disk can be improved considerably.

Having seen how the data is physically held on the disk, we can now look at the drive mechanism itself, and see how the disk controller manages to read from different tracks and sectors.

When the disk is put into the drive and the door closed, a cone-shaped clamping device passes through the central hole to align the disk and lock it to the spindle. In 5-inch units, the disk is normally not turning, so this clamp can easily crush the edges of the disk. This is why good quality disks have a reinforcement around the hole, which also helps to stop the disk slipping. This is also why some drive manufacturers recommend that the drive door be closed only when the mechanism is turning. This centralisation is easier when the disk is turning.

The disk is turned by a motor through a drive belt. On 8-inch disks the motor turns all the time, on 5-inch disks the motor is only turned on when data is to be transferred to or from the disk. Also connected to the spindle is a transducer which measures the speed at which the disk is turning. If the motor is running too fast, the control circuitry will slow it down; if too slow, the control circuitry will speed it up. It is important to keep the motor speed within certain limits, as the read circuitry can only cope with a certain variation in speed.

The head is moved in and out by means of a stepper motor driving a lead screw. A stepper motor is a motor which can be turned through a very precise angle, usually 15 degrees. With the spindle drive motor we apply a constant voltage and it rotates continuously; with a stepper motor, we apply a short pulse and it turns through one step, either clockwise or anticlockwise. As the stepper motor turns, the head moves, either towards or away from the edge of the disk. We know how many pulses we need to apply to the stepper motor to move from, say, track 10 to track 17, so moving the head from one track to another, called *seeking*, is quite an easy operation, although it is quite slow on a floppy disk.

Having arrived (hopefully) at the track we want, the disk controller now energises the *head load solenoid*. This actually pulls the head into contact with the disk, ready for reading. When the head is loaded, the controller searches for a sector header, and reads the track and sector number. Hopefully, the track number corresponds to the number the controller was looking for. Occasionally though, something, may go wrong and the wrong track is reached, or the head may end up in between two tracks. There are two things the controller can do. It can go all the way out to track 0 (a process called "restoring"), then try another seek operation (a process which can quite clearly be heard on, say, Apple drives), or it can hunt around for the track, moving half a track at a time. The first method is fine if the wrong track has been found, but may not help in the case where the head is in between two tracks, because this may be due to the drive not being adjusted correctly. Modern controllers sometimes use both methods, "half-tracking" first and then restoring to track 0 and retrying the seek if all else fails. Whatever method is used, the seek will be repeated a number of times before the controller reports, "Seek Error" to the computer.

Assuming that the controller finds that it has found the track it wants, all it has to do is find the right sector, and then it can read or write data as requested by the computer. This means playing a waiting game; the controller reads every sector header, which comes past until it finds the one it wants.

In the interests of safe recording, whenever the compu-

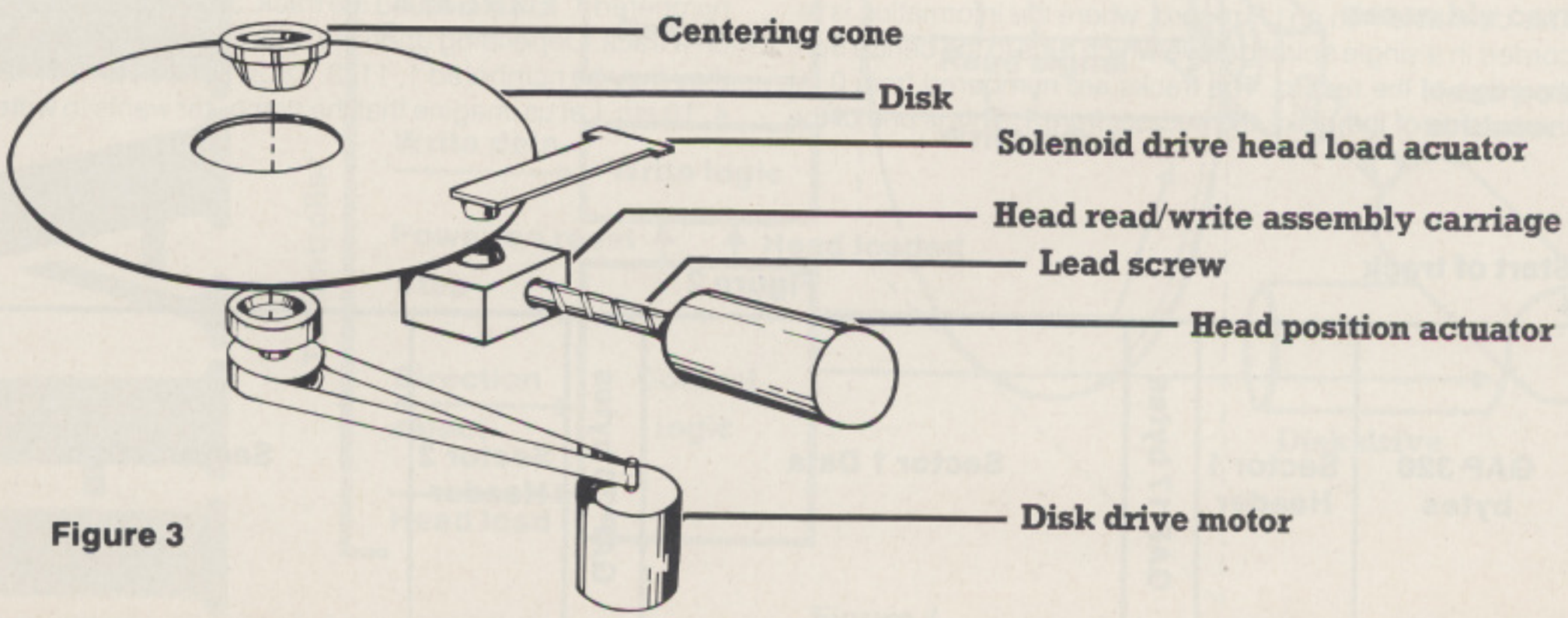


Figure 3

ter writes a sector to the disk, it immediately reads it back again, to verify the data was actually recorded correctly. This is called "Read after Write Verification", and explains why writing to a disk is usually much slower than reading from it, although some machines do use "Read after Read Verification" as well, which tends to even things out. As with the seek operation, if an error is found, the read or write will be repeated a number of times before the controller gives up and says "Read Error" or "Write Error".

Recording Format

Up till now we have been glibly talking about data being recorded on the disk as though there was nothing to it. In fact, this is probably the most risky part of the whole process, actually converting data between an electrical signal in the head and a magnetic pattern on the disk. Each byte sent to the disk has to be converted from the parallel form in which it is sent out by the computer, to serial form. In other words, the data is sent to the head one bit at a time.

The simplest system of recording is to do just this: send the data to be recorded on the disk one bit at a time. This diagram shows a byte as sent by the computer and the string of bits sent to the head:

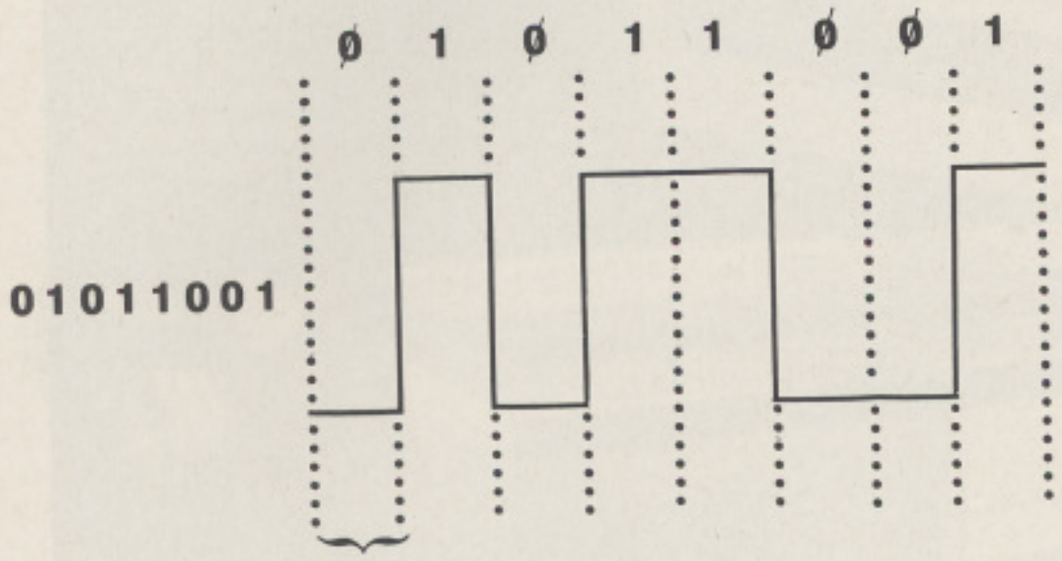


Figure 4

The problem with this system is one of synchronisation when the disk is reading the data back. If the data consists of ones and zeroes well mixed up, the read circuitry can easily keep track of where each bit starts and ends. However, what if part of the data consists of a long string of zeroes? During this time the disk motor may speed up, but the read circuitry cannot tell, because the voltage from the head is not changing.

It is a bit like the situation where there are a number of people in a room, and you tell them to count to ten and then clap their hands together. Each person counts at a slightly different rate, so each one will reach ten at a different time. Now if there is a clock, or a metronome in the room which gives a loud click every second, the people can count the clicks and thus synchronise their counting. This time they should all clap together. This is the technique usually used on floppy disks. In between every data bit sent to the disk is a clock bit, which is used to hold the read circuitry "in sync" with the data:

Now even if a string of zeroes is recorded on the disk, the read circuitry can still lock on to the clock pulses, and keep in step with the disk, even though the disk speed is changing.

This recording format is sometimes called FM, which is short for *Frequency Modulation*, because in each bit cell, there are two pulses for a "1" and only one for a "0". Notice that the same data takes up twice the space on the disk using this method as it did using our simple recording system above, because of the space "wasted" by the clock pulses. We can recover some of this space by using a more complicated system called *Modified Frequency Modulation*, MFM for short. Although this is too complex to go into here, this is the system used on so-called "double-density" disk drives, and results in a much higher "packing density", that is the number of bits of data recorded onto each track.

In the next issue we shall be looking at the role played by the Disk Operating System, which manages the information held on the disk and provides the interface to the users programs. ●

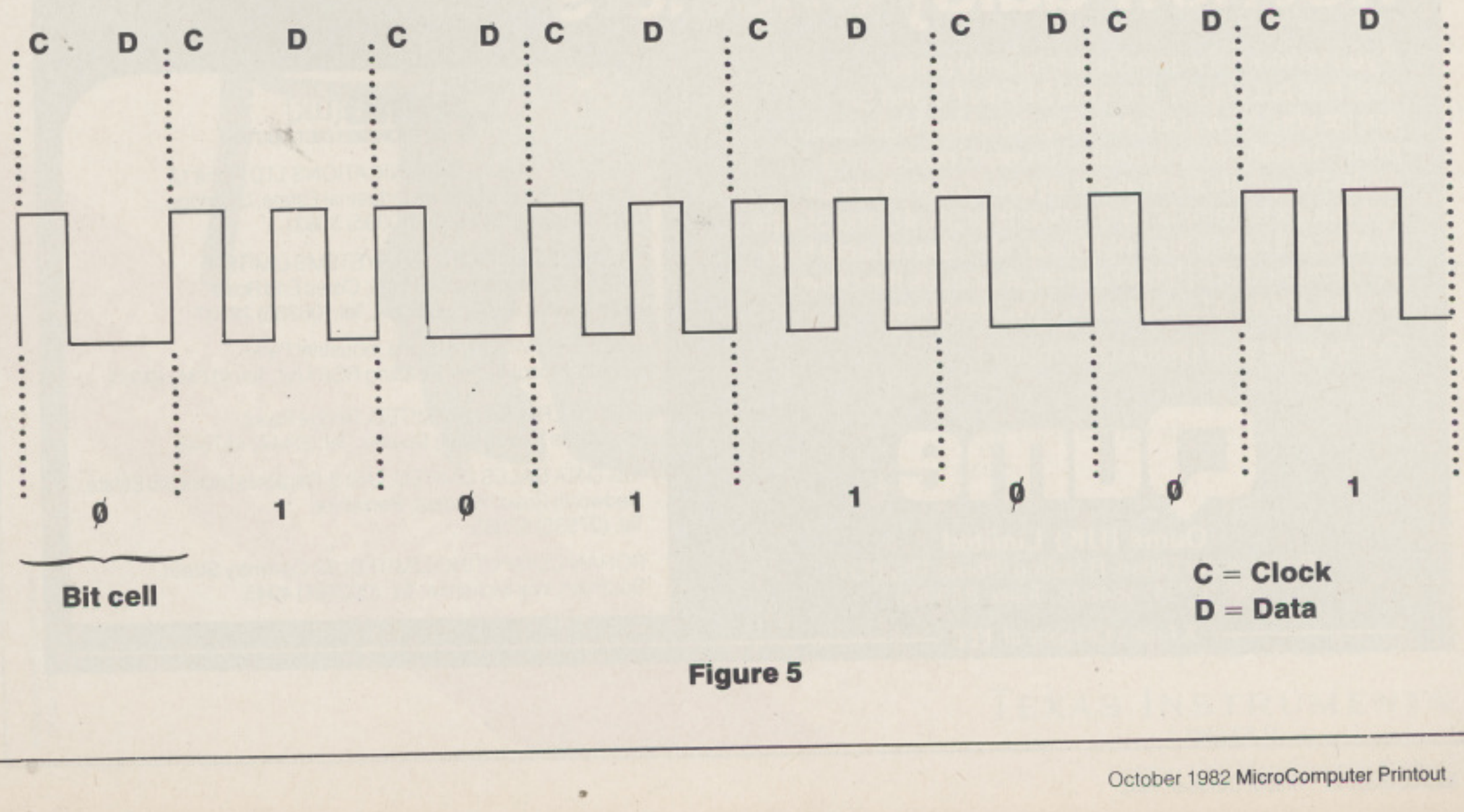


Figure 5

QUME

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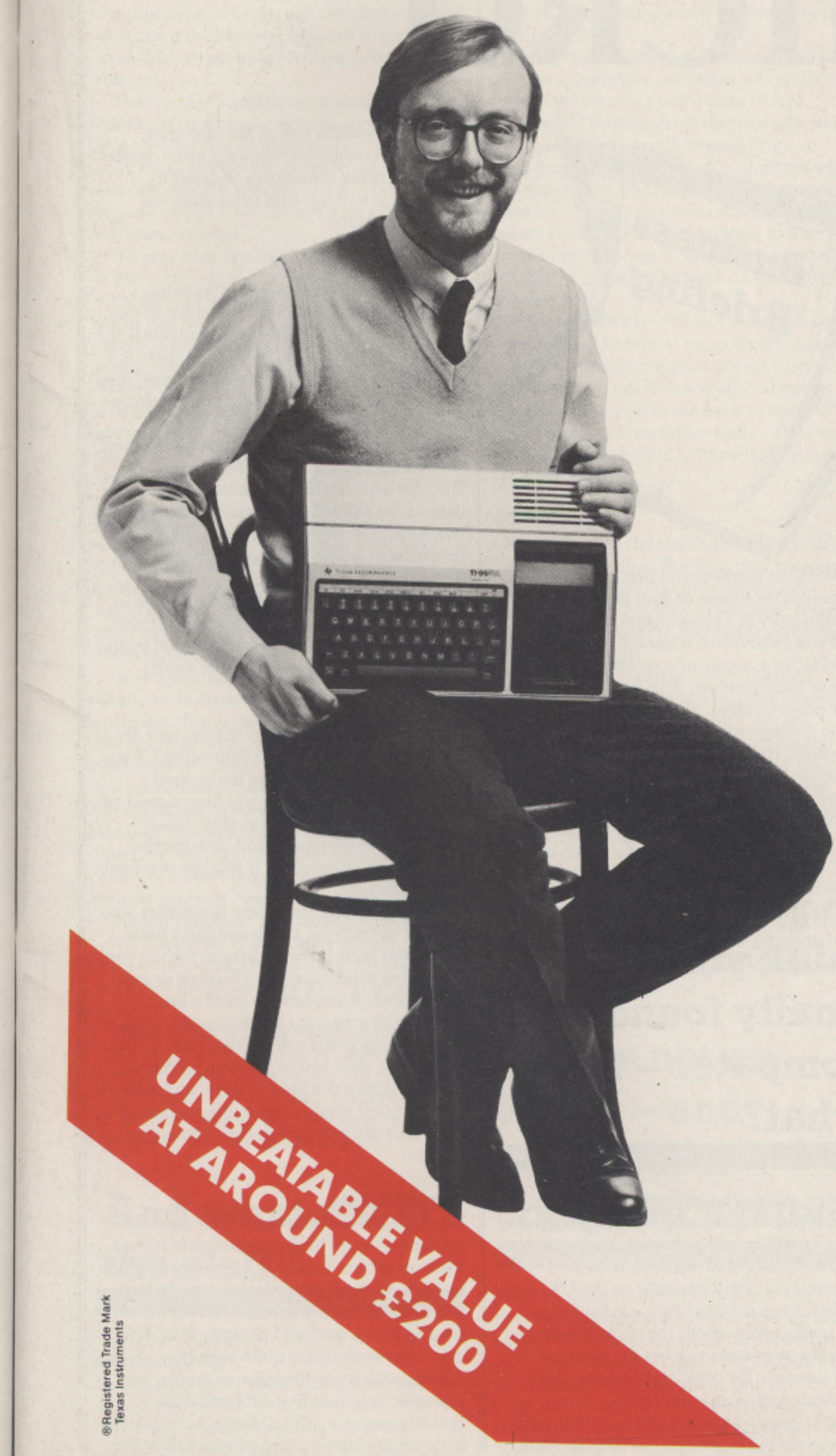

Make the right move into computing with the Home Computer from Texas Instruments. It gives you a large combined RAM/ROM capacity up to 110 K Byte and the ability to expand with a full range of peripherals and software. So as your knowledge of computers increases the TI Home Computer will grow with you.

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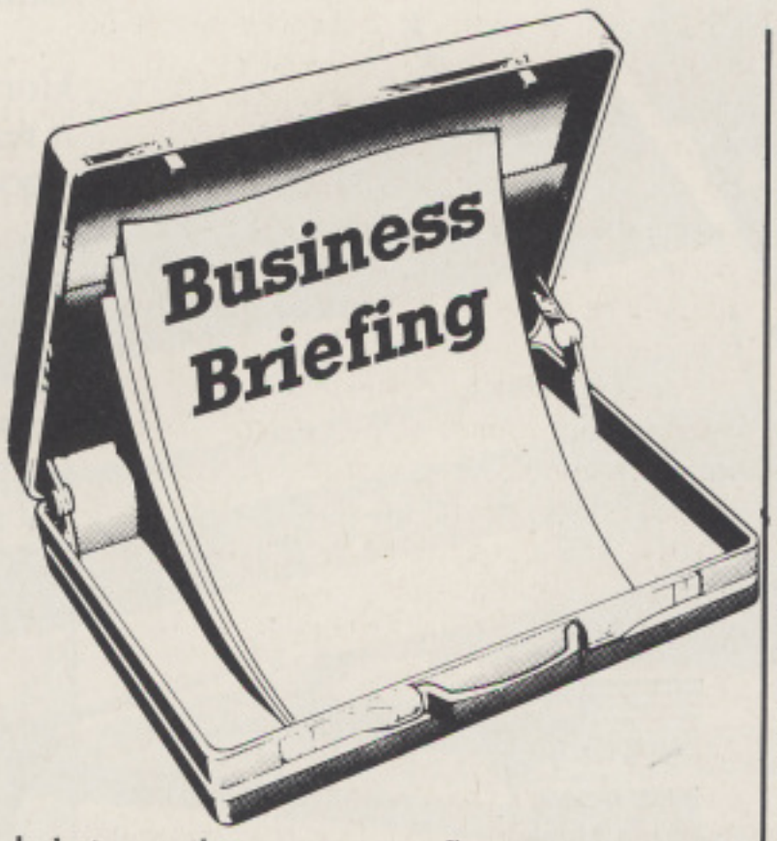
Choosing the right business computer system is only half the problem: next comes the installation. *Charles Christian* develops an invaluable checklist which could prevent many of the problems associated with installing a new micro.

INSTALLING A MICRO

From the showroom to your office – there can be no short cuts.



From glancing through the multifarious sales and promotional literature of some companies, you could be forgiven for thinking that buying your first microcomputer system will be a relatively straightforward process.

"Remember the hardware and the software" is the message all the brochures hammer home almost ad nauseum. Just weigh-up the respective virtues of the different systems you see: will 64K of dynamic RAM give you enough internal memory; can you get by with just IEEE interface buses; do you need a capability to use other languages besides BASIC; and so on. Then, all you have to do is produce your cheque book and, in less time than it takes to say "dual mini floppy double density disk drives", the salesman's face will light up with a smile, a heavenly chorus will begin to sing and sunshine will burst through the clouds to herald your business's entry into a golden age of computerisation, with greater efficiency, increased profitability and longer lunch breaks all round.

At least, that is what a lot of people would lead you to believe. But just as there is rather more to a computer than a big pocket calculator with an amazing ability for playing "Space Invaders", so there are an awful lot more factors besides just hardware and software which must be carefully taken into consideration before you finally sign on the dotted line and buy your first computer system.

The problem is: a lot of these factors are often fairly minor little niggling things which the salesman, in all fairness to him, may be totally unaware of because they reflect some particular idiosyncrasy of your own particular firm. Despite their apparent triviality, however, the significance of these factors should not be underestimated. Some may force you drastically to revise your ideas about the hardware you are going to buy, whilst others may result in you looking around for an alternative supplier.

In fact, just as "there is many a slip betwixt cup and lip", so there can be many a cock-up between the moment you first set eyes upon the computer system of your dreams in all its pristine glory in a gleaming showroom, to the time you finally have it installed and "up and running" in a corner of your office. For the sake of your business, your bank balance and your peace of mind, you want the final stages of the computer purchasing process to run smoothly. Hopefully this article, by pointing out some of the pitfalls and pratfalls you can encounter along the way, will make this possible.

So you really think you have finally found your computer – then what?

Most people can be forgiven for feeling rather smug about having waded through the dozens of different hardware systems, and literally hundreds of different software programs currently available on the UK market, eventually to find a configuration that seems to have both the performance and price characteristics to meet the needs of their business. So congratulations on the completion of an arduous task.

But if you do happen to be lucky enough to find yourself in such an enviable position, before the wolfish grin of the salesman, scenting a commission drawing near, dazzles you into finally committing yourself to anything in writing, stop to consider the following points:

●Availability

It is all very well and good opting for a "Whizzo" brand computer that does all you want it to. But if the only unit available is the dealer's demonstration model and there is a six month waiting list for new machines, then that is hardly going to benefit your business. This problem of availability is a fairly common one: Commodore had it when they first launched their floppy disk drives; the BBC Micro is having problems with delivery dates now; and ICL's microcomputer, which was launched earlier this year, is unlikely to be available in any great quantity until next Spring.

If you can afford to wait for a machine to become available, all well and good. If not? Then your best course of action would be to look elsewhere for a comparable model.

●Delivery

Assuming there is a unit available, how are you going to get it back to your office? Some dealers can arrange for the fairly rapid delivery of a system once you have signed on the dotted line. Others may take days or weeks before they get round to delivering your system, particularly if you live in an out-of-the-way area.

Then again there are some companies who operate virtually on a cash and carry basis. Whilst this is perfectly satisfactory when you are buying something like a Sinclair or even an Osborne, if you have in mind a larger system with separate keyboard and screen, a large processor and a disk drive unit, and a big printer, then you could have problems. Such things are not light to move around and size-wise they can be very bulky, particularly when they are wrapped in their protective cartons.

●Installation

Moving on from the delivery, the next problem you are likely to encounter is over the installation. Unlike other pieces of office equipment, such as an electric typewriter, where installation is a simple matter of placing it on a desk and plugging it in, few computer systems are quite so easy.

Even with something like an Apple, for example, you have five different units: central processor, visual display unit, printer and two disk drives, each of which must be

connected to the other in a particular way. Once you are familiar with a system then setting it up becomes child's play, but when it is new to you, all those interface cables, plugs and sockets can look dreadfully similar.

Assuming you master this point, there is then the problem of actually turning on the system and getting it running. This may seem like a rather ludicrous point to make, especially if you have a "user friendly" program – which means messages in words of no more than one syllable are flashed across the screen to prompt the non-technically minded members of the public like you and me, to press the right keys. However, with the profusion of knobs and switches on some systems, it is often very difficult to decipher from the user manual just how to turn the thing on.

Far too many computer manuals and operating handbooks unfortunately assume that the user has considerable experience of computers and devote pages to discussing esoteric subjects unlikely to be of interest to anyone except a few boffins with PhDs in computer science.

To give your system the best start in life it is therefore advisable to go to a dealer who can offer full installation. And as a practical tip, if you do have an engineer come to install your computer system, do not let him out of your office until he has explained how to feed paper into the printer – as these have a habit of running amok and shredding everything in sight – and how to insert floppy disks into the drive unit and "initialise" them.

●Location

One final point, before leaving what might be described as the hardware orientated problems. Although most microcomputers are genuinely desk-top units, the problem of their size and just where you are going to put them cannot be ignored.

If you put them too close to a wall or a heater or in dirct sunlight, then they will overheat. If you put them in a gloomy corner the operator will get eyestrain. If you put them directly under artificial lighting you will get reflections or shadows blurring the image on the screen. You may have to invest in special items of furniture to hold the computer so that the operator can use it easily or so that the paper can be fed into the printer properly, and wires kept safely out of 'tripping' distance! You may have to set aside a separate room for the system, for with its fans and printers it may be too noisy for other people to work with. The list is endless.

Above all never underestimate just how big your "micro" really is. At least one company of my acquaintance had to take all their internal doors off their hinges in order to get their, admittedly fairly large, printer console into its designated location.

And what about the staff?

●Operating

Before ever going out to buy a computer you should pay particular attention as to who you eventually intend to operate the system. "Good old Doris" in the accounts department may have quite happily carried out your company's book-keeping for the last forty years on everything from quill pen and ledger book to a big mechanical NCR machine. You should not, however, just assume that she will be equally enamoured of the charms of "new technology", "the electronic office" and all that stuff Kenneth Baker has been preaching to us during "IT82 Year".

Faced with the prospect of computerisation, it is not unknown for old retainers to decide that "enough is enough", collect their cards and retire. The result is that your accounts department is left in the lurch and you have to go to the trouble and expense of recruiting a new employee to take over from Doris.

Even if your existing staff are prepared to tolerate a computer, whatever you do, please consult them before you decide to buy anything. It is quite surprising just how many computer systems are purchased by managing directors or finance directors who will never have anything to do with running them on a day-by-day basis and without paying the slightest consideration to the views or preferences of the people who will actually be expected to work on them five days a week.

You may think it very nice to be able to boast to your friends at the golf club that your new computer represents the forefront of technology, but if your staff find that in practise, it is a pain in the neck to operate – both literally and metaphorically – then you will not be doing them or eventually yourself any great favours.

●Training

Closely allied to the staffing element is the question of training. For first-time computer users it is essential that at least one key operator of any system you purchase is sent on a training course to learn how to run the programs properly.

The problem you will inevitably find, however, is that "there are training courses, and there are training courses". Some content themselves with only teaching the rudiments which really ought to have been explained at the installation stage. On the other hand, others give proper lessons going into not only the practical considerations, but also devoting time to explaining the conceptual bases behind a particular program.

Just how much training you do or do not get should therefore be another factor to be considered before you make a final choice on a computer system.

Man is not an island – and neither is a computer system

Whilst considering all these factors will considerably help you towards making the right choice, they should not be viewed in a complete vacuum. To get a truly balanced picture you must also look at your prospective computer system in the context of your existing office systems and procedures.

It may well be that your manual system has a number of attractive features which are particularly useful to your business. For example, the beauty of a ledger card system is that if you want to enter just one or two items, it takes only a couple of minutes work with a pen, if that. On the other hand, with many computer systems, to start them up from scratch each day is a slow, laborious process and a highly inefficient use of time if only a handful of transactions are going to be entered.

It could be therefore that some of the useful facilities on your existing system are lost in favour of the overall improvements offered by computerisation. Just how crucial this is to you will very much depend upon your own business criteria. But it may well be worthwhile spending a little more time and money to get a computer system "configured", that is to say, adapted and enhanced, to meet your particular needs rather than just "getting by" with a system that "more or less" does what you want it to.

It is also worth bearing in mind that the installation of a new computer system inevitably brings with it a large degree of disruption. Staff have to go on training courses; the layout of the office has to be rearranged; and all the old manual records, such as the names and addresses of employees; their pay rates and their tax and deduction codes, if, for example you are setting up a computerised wages system, have to be laboriously entered into the computer.

To do this properly can take a very long time. To begin with you must rearrange your existing routines and information into a logical structure that will fit in with the computer's way of working. It is one of the sad facts of life that no matter how good your computer may be, it will not automatically help you if your paperwork and business records are in a disorganised mess. In such circumstances all that buying a computer will do is to convert an inefficient manual system into an inefficient computerised one. Or, as they say in the computer industry, "GIGO – garbage in, garbage out".

Having streamlined your office routines as a preliminary to computerisation, and it is not unknown for some companies to achieve such an improvement in efficiency that it becomes unnecessary to go ahead with the purchase of the computer after all, your next problem is the actual "keying in" of all the data into the computer's memory. Depending on the type of business you are, this could take anything from two hours to six months. And during that time you will be existing in an uneasy "limbo" with, for example, manual and computerised ledgers being run in tandem.

Once through this stage the promised land of computerised efficiency should be in sight and then you and your business are well and truly committed. And this is one reason why it pays to get all possible snags sorted out before you complete the purchase, because inevitably it is far easier to computerise a system than it is to decomputerise and go back to a manual way of working.

As far as the computers are concerned, on the UK market at the moment there really is something for everyone. But it is a long way from the dream of the computer dealer's showroom to the grim reality of your office. If you are going to get a system that does what you want it to and fits in as near as possible with your existing office arrangement, then it is essential that you take no short cuts. ▶

What the dealers say....

"Far too many just do not think the whole thing through and that is where they come horribly unstuck – inevitably the people who buy the computer are not the ones who have to use it...." **Peter Wills of Mercator Computer Systems of Bristol.**

"It is a false economy to buy a cheap off-the-peg system from a cowboy operator. It may look like a bargain but inevitably such factors as 'capability', 'capacity for growth' and a lot of practical considerations are completely overlooked. We therefore always advise our potential customers to discuss their needs with a systems analyst first. It pays off in the long run..." **Paul Alcan of Core International of Birmingham.**

"Proper training is not cheap and the tutor must be able to communicate. The problem is a lot of dealers know about the technology but they don't understand the business the customer is in and cannot explain the concepts behind the software...." **Paul Conroy of Microplan of London.**

"A lot of the time the market gets what it deserves with customers thinking they know what is best for them and refusing to take the advice of professionals. They don't seem to realise there is a big difference between buying an off-the-shelf package and actually getting it up and running in their own business..." **Chris Robinson of Chris Robinson Consultants of Dunstable.**

What the users say....

It is not just dealers who have opinions about this subject but users as well. However, to get more of a flavour of the problem I spoke to the actual operators rather than the people who made the purchasing decisions. Despite their criticisms most of the operators still want to retain their jobs so I have refrained from identifying them or their employers.

"The training was non-existant, we just had a couple of boxes containing all the parts delivered to us and were left to muddle through with the manual."

"The salesman may have known his job but he was incapble of explaining anything to us in anything but jargon."

"It was only after we had the system a couple of weeks that we began to appreciate just how limited it was..."

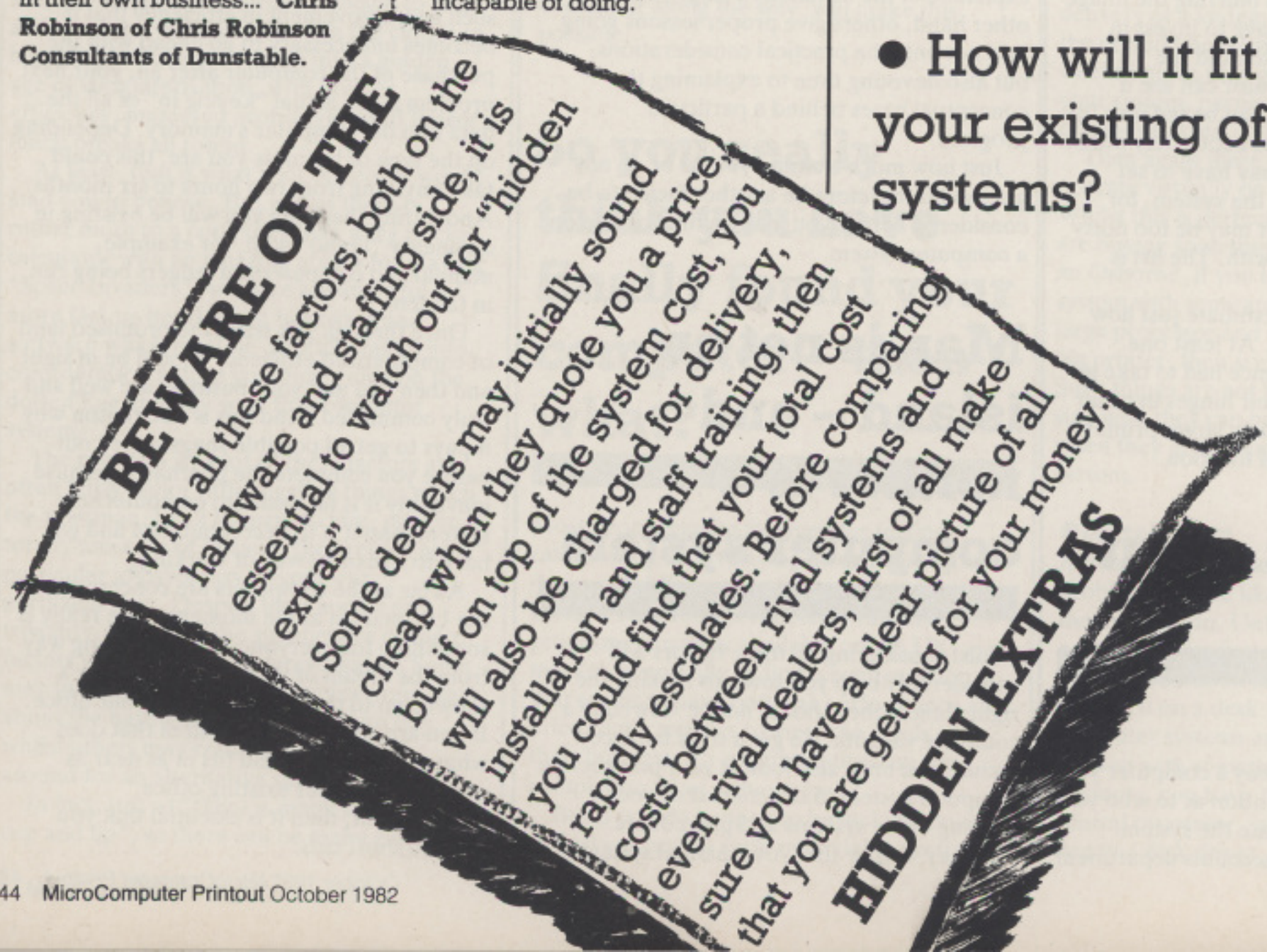
"We were led to believe it could do a lot of things before we saw it, but the dream was very different to the reality."

"Training is alright but it is only after you are familiar with the machine that you begin to spot problems and run into snags."

"The only real problem we had was the management who actually bought it; they kept pushing us to get it to do things we could have told them it was incapable of doing."

LAST MINUTE CHECK LIST

- How long will you have to wait for the machine of your choice?
- Who is going to deliver it to your office?
- Who is going to install it and set it up for you?
- Where are you going to put it?
- Who is going to operate it?
- What arrangements exist for training?
- How will it fit in with your existing office systems?



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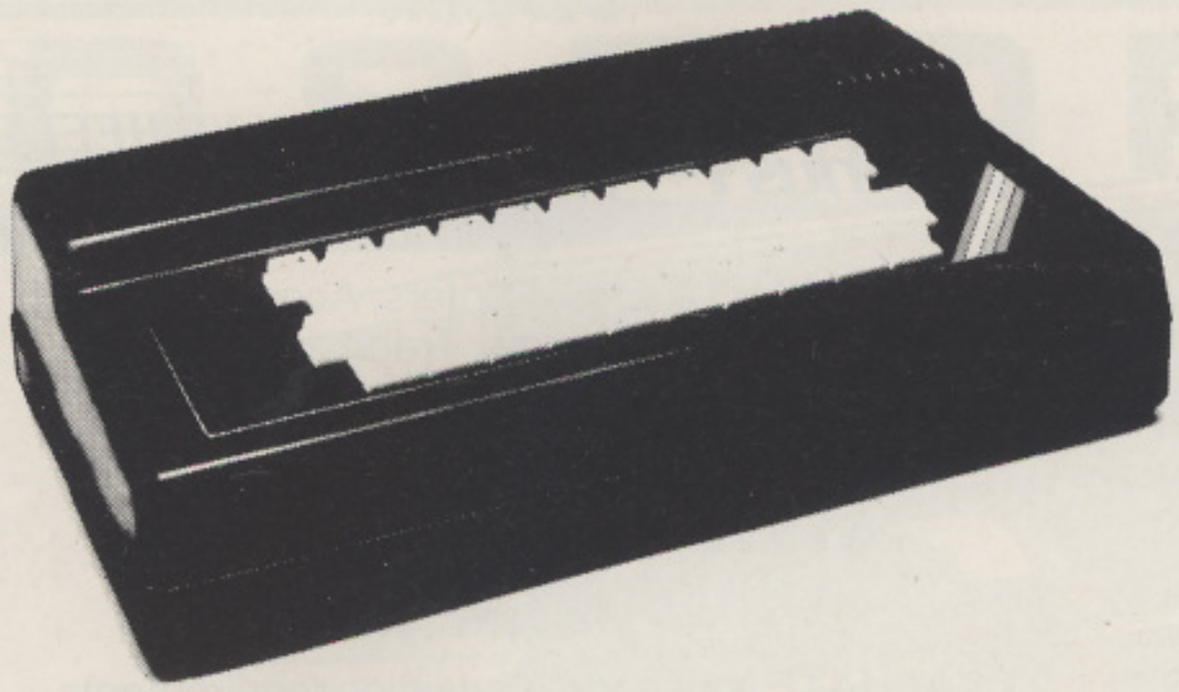

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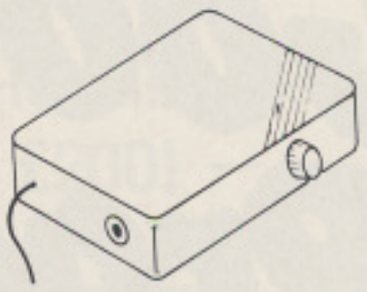

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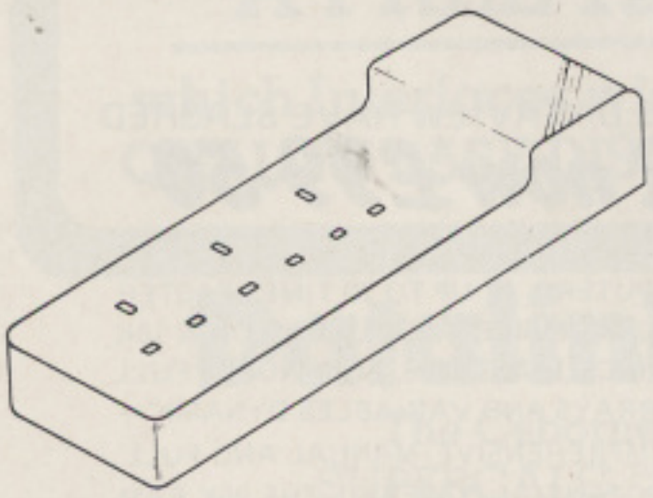

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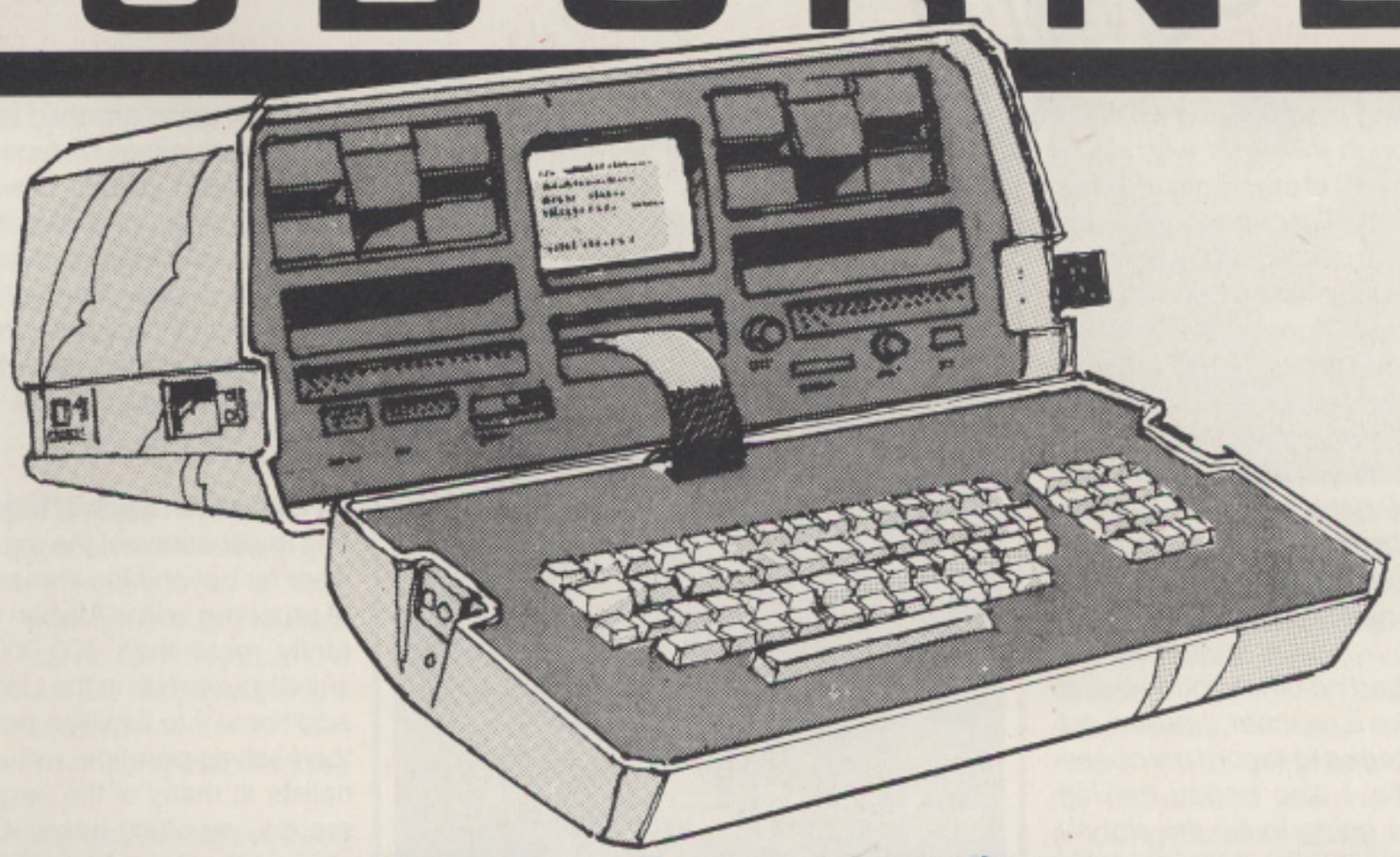

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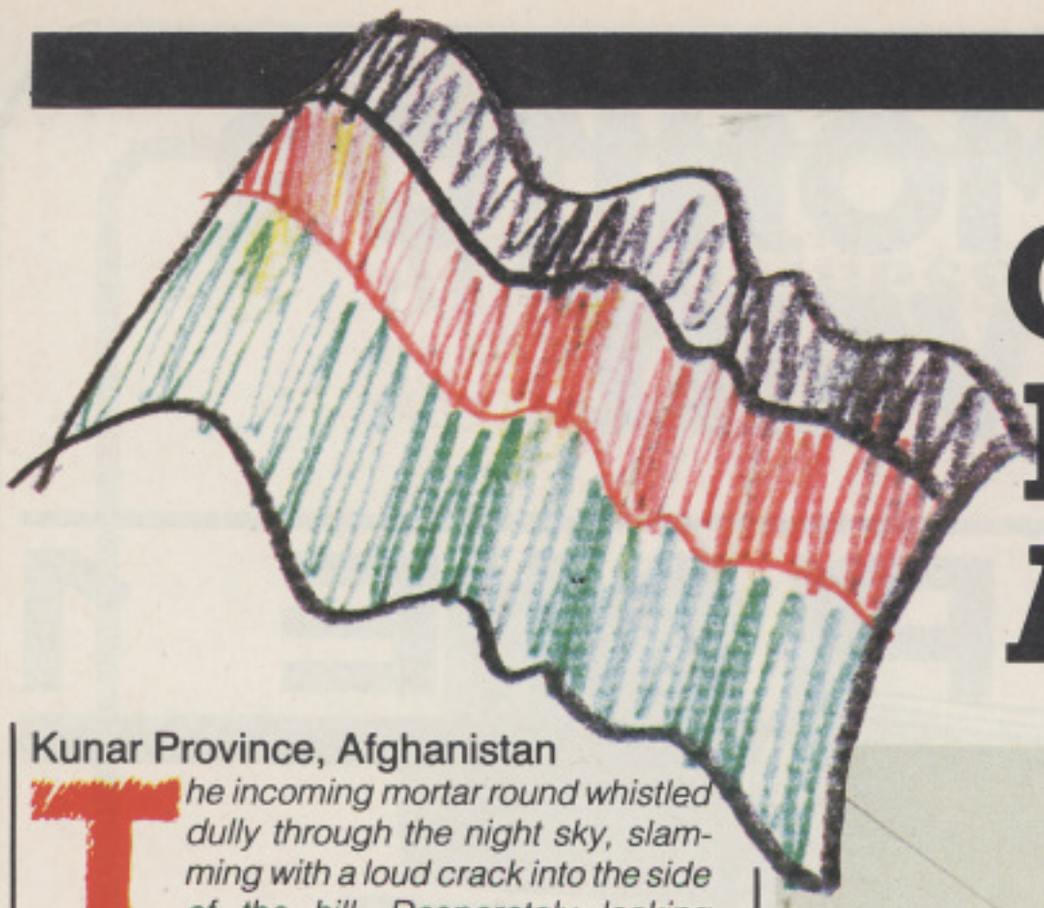


OSBORNE IN AFGHANISTAN

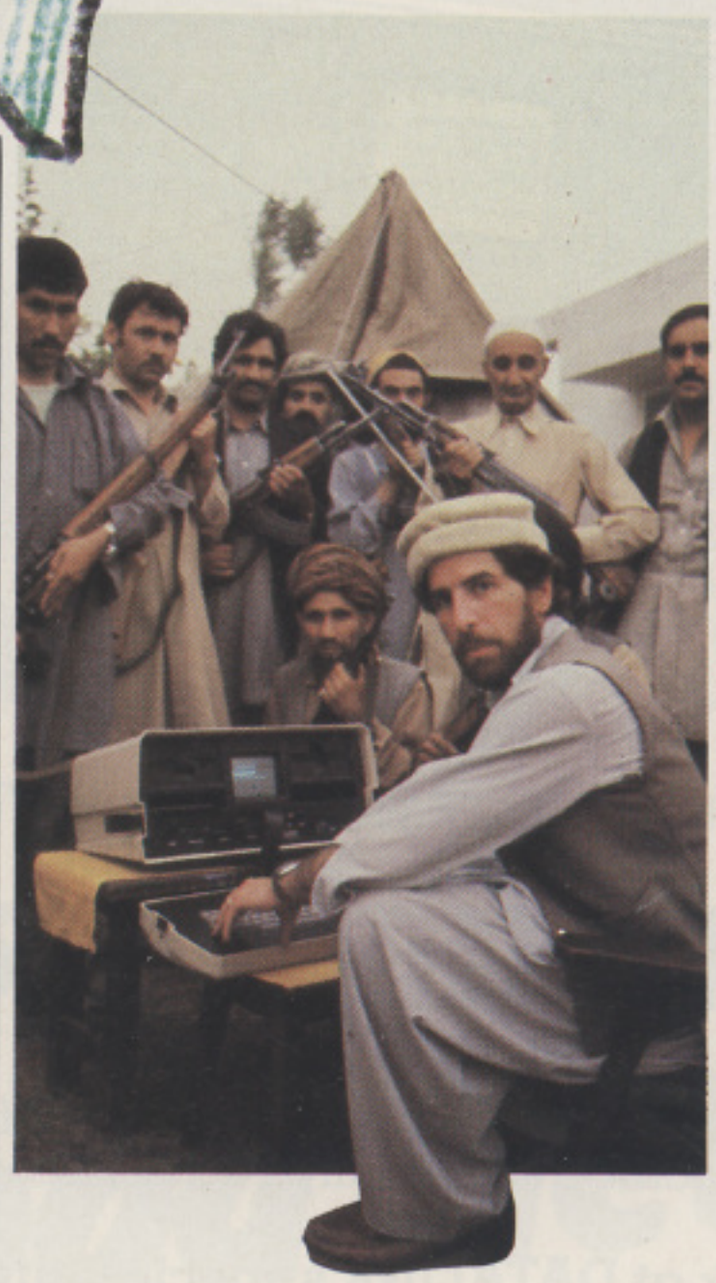
Kunar Province, Afghanistan

The incoming mortar round whistled dully through the night sky, slamming with a loud crack into the side of the hill. Desperately looking around for cover, a dozen Islamic guerrillas in turbans fired their rifles and machine guns ineffectively at the pro-Russian militia position on the ridgeline above. Then another mortar round crashed into the trees 50 yards away, temporarily drowning out the staccato sounds of automatic rifle fire all around us.

Me, I lay flat on my back, trying to calculate the odds of the mortar crew above us lobbing one directly into my lap. It occurred to me that I wasn't being paid nearly enough for this assignment.

Seeing as how I had no other option but at least to try to act like a reporter, I pulled out my notebook and started to record my observations of the battle. I also began making plans for how I was going to file the story. I faced a three day walk over the mountains before I could get back to civilization – the dusty little frontier town of Peshawar, Pakistan, just 20 miles from the legendary Khyber Pass on the Afghan-Pakistan border. But even once I arrived, I still didn't know if I'd be able to file. For I intended to employ equipment never before used from this part of the world: a portable computer and telephone modem.

Oh well, first things first, I told myself. And the first thing I had to do that night was to find a rock to crawl under.



Freelance journalist *David Kline* spent a month living with the rebels in Afghanistan. He used an Osborne 1 computer to file stories back to the U.S. faster than the international press agencies...

The experiment, for that's what it was, first took shape in late 1981. I had already decided to purchase a portable Osborne computer for word-processing, mail list and business applications in my free-lance writing agency. Then, when I was asked by CBS News, the *Chicago Sun-Times* and the *Los Angeles Times* to go back on assignment to Afghanistan (it would be my fourth trip in three years), an idea began bubbling in my head. Could I take the Osborne with me to the war zone, or at least close to it, and use the machine both to write and file my stories?

The advantages of using a computer as a reporter's tool in a situation like this would be significant. First and foremost, any articles I would write using a word-processing computer – with its quick and easy ability to edit and re-edit copy – would naturally be superior to what I could either write longhand or what I could hack out on a clackety manual typewriter. But also, if I could use a telephone modem or some other transmittal system to get my copy back to the newspapers, I could avoid the costly and often unreliable public telex offices in Pakistan.

Ordinarily, free-lance journalists like myself not based in a telex-equipped overseas office must go to a public telex office and present hand-written or typewritten copy to an often-bored and always insufferable bureaucrat-of-an-operator. He may or may not send your message that day, may or may not send it as written, and may or may not send it at all if it happens to offend his government (most telephone and telex systems outside the United States are government-owned and operated).

Professional writing tool

The implications of the experiment, however, went far beyond the immediate practical task of reporting on the Afghan war. There are currently more than 100,000 full-time professional journalists in the United States, with an additional 2 to 3 million people who consider themselves part-time writers. While staff journalists at many of the larger daily newspapers do use office-based CRTs to write their stories, the use of portable intelligent terminals or computers in on-location reporting is not at all common. And as for free-lance writers and journalists – that majority of our profession who don't have access to large office-based computer systems – the potential of computer technology as a professional writing tool is only now being examined with any seriousness.

The point, then, was simple: if I could successfully use a computer to write and file articles from the Afghan war zone – with all the inherent problems posed by using this technology in a third world country 12,000 miles from the nearest Computerland dealer – then presumably anyone could use the same technology from Podunk, Illinois, or anywhere else in the world.

From the start, the project faced a number of questions that needed answering:

- Was an Osborne durable enough to stand up to the punishments of a 12,000 mile journey by plane, bus, car, horse, camel and foot? Would it operate in the hot, dusty and dirty Asian environment?
- How does one get the Osborne to operate on Asian electrical currents, and what other power modifications would be needed for the modem and any other peripherals?
- Will a modem work from half-way around the world, and if so, what type of modem and baud rate should be used? What communications software should be used?

These were merely the main hurdles that needed to be crossed, of course. There were literally dozens of other questions that needed answers before I could leave for Afghanistan. These ran the gamut from finding out whether I needed a U.S. Commerce

Department export license to take a microprocessor out of the country (no); to whether Pakistan's military martial-law government allowed the transmission of data over phone lines (yes or no, depending upon who you talked to); to how I was going to explain the concept of a personal business computer to a Pakistani airport security officer whose natural inclination after examining the Osborne would be to associate me with the CIA.

'Hollywood typewriter'

Luckily, this last question never came up – my description of the machine as a "Hollywood typewriter" was usually glumly accepted. But since I had no desire to spend a few weeks in a Pakistani jail, I brought along a lot of magazine advertisements to demonstrate the wide use of computers among everyday consumers.

I won't go into all the details of how each problem was solved, each question answered, but suffice to say that I called literally hundreds of experts in the computer and communications field. I even placed questions on computer bulletin-boards, and in at least one instance, solved one problem that way.

Among those who helped the most, Mr. Stan Sharman and the entire staff of the Computerland store in Niles, Illinois, were instrumental in determining the various modifications I would need to make in order to use the Osborne and modem in Pakistan. Actually, it was rather simple in the end, and I learned to switch the Osborne internally from 115 to 200 V AC myself. But in the beginning, we didn't know what would be required.

Next, Mr. Wayne Holder of Oasis Systems in San Diego generously put together a prerelease copy of his superb spelling-checker software program, *The Word*, especially condensed and modified for the Osborne's minifloppy drives. *The Word*, incidentally, is superior to any other spelling software I have seen, and for only $75 is only one-half to one-third the price of its competition. As a journalist, I value its word-count capability far more than its spelling correction programs,

because when an editor says he wants 900 words, he really doesn't want 905.

In addition, the folks at Electronic Specialists, Inc., in Natick, MA, were extremely helpful in rush-modifying one of their excellent Kleen Line power filters and spike suppressors. Without this device, Central Asia's erratic currents would have reduced my Osborne to just one more charred and smoking casualty of war.

But most important of all to the project was Mr. Marty Cawthon, of the Cawthon Scientific Group in Dearborn, MI. The firm specialises

OSBORNE IN AFGHANISTAN

in computers and computer-communications, as well as custom software development. Marty put in literally dozens of hours trying to answer questions and solve problems as they came up, even when I was in Asia. He also acted as my relay to the various newspapers I was working for. Since these did not have error-checking ability in their computer communications programs, the plan was that Marty would first receive my articles via the Modem 7 error-checking communications program, then retransmit them the short distances to the newspapers involved.

On the road

By March 21, I was ready to leave. Armed with my Osborne 1, a U.S. Robotics Phone Link acoustic modem capable of transmitting at 300 baud, a powerline filter and spike suppressor, various adaptor plugs and a Radio Shack converter to power the modem, the necessary software, two disk drive cleaners, my manuals and a couple of screwdrivers, I set off for Asia and the Khyber Pass.

The first stop on my journey was Paris, where I had an assignment to interview exiled Iranian president Abolhassan Bani-Sadr. The interview would provide me with my first chance to use the computer in a foreign environment, operating at 220V AC, as well as the first test of the modem in transmitting clearly an article over phone lines at great distances.

On the morning of March 23, I arrived for the interview at Bani-Sadr's heavily-guarded appartment in the Parisian suburb of Cachan, and by 2:00 pm I was back at my hotel near the Place d'Opera in the centre of the city. For the next five hours, I wrote and rewrote my article, enjoying the ease of editing which *WordStar's* editing functions allow. By 7:00 pm, I was ready to call Marty and transmit the piece to him for relay to several newspapers.

I hesitated. Indeed, I was so nervous I had to go out for a walk. What if the modem didn't work? The French phones are shaped slightly different from ours – square handsets rather than round – so what if the skewed fit doesn't generate a strong enough signal through the modem? Or what if the computer and modem do work, but the French telephone operator calls the Deuxieme Bureau to arrest me for being a spy? As you can see, I was somewhat paranoid about what lay ahead, but I went back to my room, braced myself, and placed the call.

As soon as Marty answered, I set my modem to originate; he set his to answer. When I heard his carrier tone, I slammed my receiver down into the modem and punched out the command for sending a file: S B: Banisadr.Int.

Then I hit the return key and watched the machine go to work:

"File Open, size 78 Sectors," declared my computer screen. Nonchalantly, it added that it was "Awaiting Initial NAK."

No response from Marty's computer. After a second, still no response, and I was sweating. Meanwhile, the screen kept blandly repeating that it was "Awaiting Initial NAK", as if I didn't know.

Finally, I heard those lovely grating sounds of the Osborne disk drives in action – something like a flatulent woodpecker, actually – and I knew the acknowledgement was received. The damn thing was working! First it sent Sector #1, then Sector #2 and on and on it kept on going!

Then I noticed something amiss at Sector #48:

"H RCD," smirked my Osborne. "Not ACK".

"Not ACK?!" I shouted back. Before I could really work myself into a frenzy, however, the problem resolved itself, whatever it was. Probably just a spike of noise in the overseas phone call.

"Send Sector #49," the Osborne began again, this time (or so it seemed to me) in a tone of disapproval over my obvious emotional instability. And so it went, all the way up to "Send Sector #78." Then came, finally, "All Transfers Completed!"

OK, so I successfully computed from Paris, a city, after all, that is very much at the center of our modern technological world. The real challenge lay ahead. It still remained to be seen whether I'd be able to use a computer as a reporter's tool from the legendary Land of the Khyber, where life has hardly changed at all in the 25 centuries since Alexander the Great's conquering spearmen first met and fought the fierce Afghan tribes in battle.

Afghan Trek

After two weeks behind guerrilla lines, I was ready to return to base. It wasn't just the physical stresses of the journey, nor was it the debilitating effects of the various creatures who had decided to make my stomach their home. Simply put, I had what I came for – a detailed analysis of the state of the Afghan war after three full winters of Russian occupation, as well as interviews and photos of all surviving Soviet prisoners held by the rebels – and now it was time to start filing my reports.

By April 15, I was back in Peshawar, typing away at my Osborne in Dean's Hotel, the favourite haunt of Western journalists. First, I decided, I'd type up a detailed outline of my observations, suggest a breakdown and order to my articles, and file that with my editor at the *Chicago Sun-Times*. After looking at my material, he'd tell me which piece to file first, what length in words, etc.

Of course, everything depended on whether I could even use the modem successfully from Peshawar. No one had ever tried it before, and there were some significant hurdles to be overcome.

The telephone call itself, for example, would have to travel 1000 miles by microwave from Peshawar to Karachi, then 6000 miles by satellite from Karachi to London, and finally another 5000 miles via undersea cable to New York and then Dearborn, MI. There, Marty Cawthon would try to catch my scattered signals out of the ether and make some sense out of them. But at that distance, with at least a 500 milli-second delay in transmission, the chance that the distortion would be strong enough to prevent reliable transmission was great. Indeed, it was very hard to hear someone on the other end of the phone at that distance.

Then there was the possibility – nay, the likelihood – that a Pakistani telephone operator listening in on the call would cut us off at the first hint of beeping rather than talking. We could reduce that risk by having Marty call me and thus go through an American operator rather than the other way around, but still we didn't know for sure that the military authorities wouldn't have people listening in on all overseas calls.

And finally, there was the possibility of the power going out in my hotel room, what with my Osborne and modem running off one outlet. The watt usage was certainly not great, but who knew the limits of a hotel electrical system in a city that only recently was electrified?

On April 16, at 6:00 pm, I placed a call to Marty, asking him to call me back for transmission. While waiting for the return call, I set up my modem and got a shock: the phone simply wouldn't fit in the modem's handset because it was a good inch longer than the standard size. I could have kicked myself for assuming anything in this part of the world, and for not checking to make sure that the hotel room phone would work.

So when Marty called, I gave him another number to call in an hour, the number of a friend with a phone that would work. Then, folding up my Osborne and throwing the modem, power filter and attachments into a camera bag, I grabbed a horse-drawn rickshaw and raced over to my friend's house to wait for Marty's return call.

At 8:00 pm sharp, Marty called again. I set the modem on originate, and when I heard his answer carrier tone, I placed the phone in the handset and punched out the code for sending a file.

"File Open, Size 68 Sectors," flashed the screen, followed by, "Awaiting Initial NAK."

One second, two seconds, three ...nothing was happening! I picked up the phone, as did Marty, and asked what the problem was. He didn't know. Try again, he suggested.

Once again: "Awaiting Initial NAK". And once again, no acknowledgement from Marty's computer! Over the next ten minutes, we tried just about everything we could think of, variously setting my modem on originate,

answer, half-duplex or punching out alternate codes for sending a file on Modem 7. Nothing worked.

Then Marty had an idea? "Start counting backwards from 10," he urged. "I want to try something." As I began counting, he started talking at the same time, but I couldn't hear what he was saying.

One way circuit

"Just as I thought," Marty announced. "Somehow, I think we've got a one-way circuit here. The signals can only go in one direction at a time."

The significance of this fact escaped my technically unsophisticated mind, until Marty clued me in. It seems that our modem handshaking program required simultaneous two-way sound transmission. Thus the one-way circuit was preventing file transfer.

"Okay, just send your file using your Microlink program, without error-checking," Marty advised. But I was so flustered by the failure, I forgot the code for loading a file into the system and then transmitting it. I told Marty to call me the next day.

When he did call the next morning I was prepared for the Microlink file transfer, though I was also concerned about the text being garbled since we weren't going to use the Modem 7's error-checking functions. Marty, too, was prepared: he had decided to tape-record my signal, then amplify it for clarity before feeding it into his computer for deciphering.

"Okay, Marty," I asked, "ready to go?"

"Give me a second," he replied, "while I make sure the recorder's set up properly."

While waiting, I gazed out the window at the fresh, crisp morning sky over Peshawar. It's going to be a beautiful day, I thought; not a cloud in the sky.

That's it! Not a cloud in the sky!

"Marty, wait a minute!" I shouted into the phone. "Let's try it once more using Modem 7. We had a big thunderstorm last night. Maybe the atmospheric disturbance blocked our transmission."

Indeed, it turned out that it had. With a circuit that morning that allowed simultaneous two-way sound transmission, our two computers were soon talking and humming contentedly to each other across 12,000 miles of mountain, desert, ocean and outer space. With only a half-dozen or so sectors needing retransmission due to garbling, my 68 sector file was successfully transferred and relayed to the *Chicago Sun-Times*. Later that day, I received a telex from the editor that since no one else could beat me on these stories, I should wait until my return to Chicago to actually file the finished articles, which would then be run in a four-part series. That way, we'd also be able to develop my film and use photos with the series.

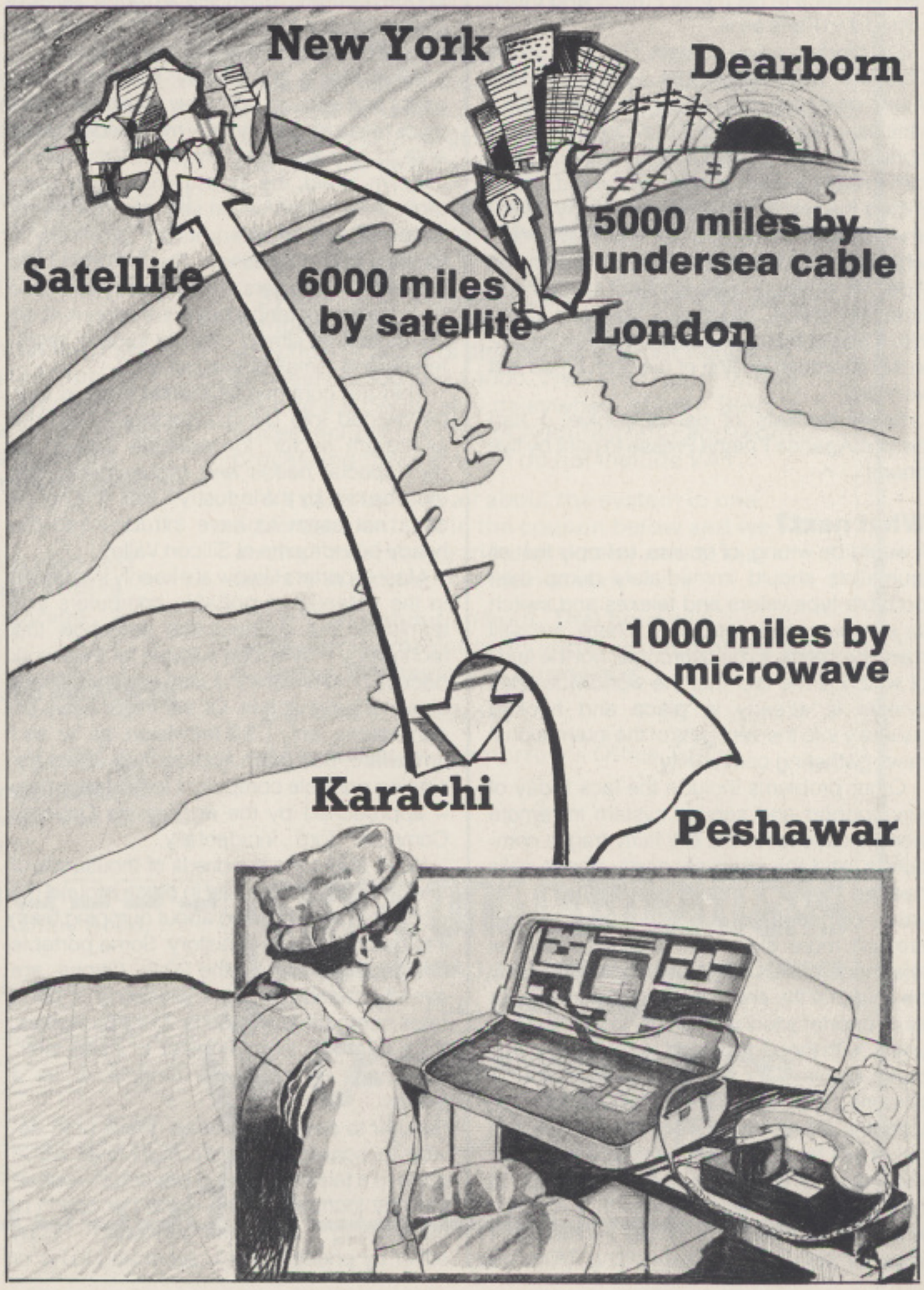
Crazy experiment

So, I thought proudly, the whole crazy experiment worked. Still, the victory was a somewhat hollow one. Though I knew a computer-plus-modem combination would work, I hadn't had the opportunity to actually test the whole system out in competition with the typewriter-plus-telex system more commonly used by reporters. As they say in war, my Osborne had not yet been tested in the heat of the battle.

Three days later, my computer received its baptism of fire. While routinely visiting my contacts in the Afghan rebel leadership, I had stumbled across an amazing piece of news. The Afghan rebels' most important Soviet prisoner, a civilian specialist by the name of Mikhail Evgeny Okrimyuk, had apparently been executed by his guerrilla captors.

Why the rebels shot this man I didn't know. What I did know was that this was a major piece of news and that I was the only one that had it. But in order to get confirmation, I needed help. I called my friend Alain Faudeaux, the permanent correspondent in Pakistan for the prestigious Agence France Presse (AFP), who was based 100 miles south of Peshawar in the city of Islamabad. In exchange for giving him the story and an equal chance to beat me in filing it, Alain would come up to Peshawar and give me those contacts of his that I needed to confirm the execution of Okrimyuk.

By 2:30 in the afternoon of April 19, Alain and I had all we needed to run with the story. Taking the room next to mine at Dean's Hotel, he began furiously hacking out his story on an ancient manual. After completing the piece, he planned to take it to the public telex



OSBORNE IN AFGHANISTAN

office for transmission to AFP's main office in Paris. Had Alain been working from his home base in Islamabad, of course, he would have had access to his own telex machine. But for all intents and purposes, we were both away from our home base, both in possession of a great story, and both working like mad to beat the other to print.

As it turned out, I had an unfair advantage: the Osborne 1 computer and the modem. With glitteringly beautiful copy stored on floppy, I finished my piece by 4:30 pm, while Alain was still working on his rough second draft. One problem for him, of course, was that he had to write the final text in English – the only language the telex operator could read. If he was back at his office (or if he was using a computer like me) he could have written the piece in his native French and transmitted it to Paris as is.

So, bidding adieu to Alain, I packed up my Osborne and peripherals, and – leaving Alain muttering his obscure French profanities – I hopped a rickshaw to my friend's house. There, I placed a call to Marty, asked him to call me back, and when he did, transmitted the text of my article in one try. Marty immediately relayed it to the *Sun-Times*, which received it at about 7:30 pm my time on April 19, or about 9:30 am April 19 Chicago time. My article, headlined "Afghans Claim No. 1 Soviet Prisoner Killed," was run Page 2 in the afternoon edition of the *Sun-Times* that very day.

Great buckets of camel puckie! I had beaten Agence France Presse to print by five hours!

What next?

It would be wrong, of course, to imply that all journalists should immediately dump their portable typewriters and telexes and switch to computerised reporting. There are still many problems to be overcome, not the least of which is the fact that the worldwide telex system is already in place and hooked squarely into the very guts of the international news gathering community.

Other problems include the lack today of any support and service system in remote world locations for the still fairly fragile computers, and the relatively costly phone calls needed to use a modem as against a privately-owned telex (public telexes, however, are still more expensive than international telephone calls). Nevertheless, it can surely be said that the era of the portable computer as a reporter's tool is upon us. In the next few years, with the widespread substitution of flat panel displays for those cumbersome CRT screens, full-capability computers like the Osborne will no longer weigh 24 pounds, but rather will be packaged briefcase size, with the essential typewriter-style keyboards, at between five to ten pounds. If a reporter would be satisfied with simply an intelligent terminal with built-in text-editing firmware rather than floppy disk drives, the weight of the machine would be reduced even further.

And with the low power generating CMOS circuitry now being widely introduced, these computers will probably come supplied with really light weight battery packs enabling a journalist to operate even in a remote Asian battlefield, far from any power source, if that's what he's crazy enough to want to do. In other words, we're talking about true portability for computers – the ability to use a computer in any environment under any conceivable conditions.

As for communications, no longer must we wait for under-developed third world countries to develop cumbersome and costly ground telephone systems. The rapid proliferation of satellite-based commercial telephone systems promises to bring reliable phone service to even the most remote corners of the earth within just a few years.

All of this is not fantasy; the technology exists and is in use right now. The task is simply to make the technology more widely available to and accepted by journalists. And in this, I'm afraid, the industry has been sadly remiss. Rarely do I even see advertisements for portable computers in our professional journals and magazines. The attitude of the marketing managers in the industry seems to be to treat all potential buyers of serious small computers as simply one big lump of undifferentiated "small businessmen."

That the commercial market may, in fact, be divided into distinct sectors – with the journalism sector, for example, having its own special needs and requirements that must be met by the industry – well, this notion does not seem to have intruded into the heady boardrooms of Silicon Valley.

Most reporters I know are keenly interested in the potential of portable computers and terminals, but suspect that somehow this technology may not be suitable for their work becuse no one in the industry has specifically shown them that it is. Of the major news organisations, only CBS television, as far as I am aware, has been approached about assigning portable computers to field reporters – approached by the aggressive Osborne Computer Corp., incidentally.

What about the hundreds of thousands of telex machines currently in place around the world? No one is talking about dumping them into the trash heap of history. Some portable microcomputers, like the 20-lb. Otrona, are already capable of communicating at baud rates compatible with 50 or 110 bps telexes. It's a relatively simple matter to install interface ports on new telex models, or for a manufacturer to develop a cheap "black box" device to convert a micro's eight-level ASCII code to a telex's five-level baudot, thus offering any journalist in the world the option of transmitting computer-generated copy either by phone or telex, according to his or her desire.

Indeed, the only hold-up in creating a worldwide micro-telex network combining the best of both systems may be the fact that in most countries of the world, communications systems are under government control. Even that problem can be solved in time, however, if appropriate agreements allowing free access to such networks by news organisations are arrived at.

A final word should be said about the Osborne computer itself. Frankly, when I began the journey, I had serious doubts about its durability. The plastic case enclosing the machine is rather flimsy and highly susceptible to dents. But I'm happy to report that all the damage inflicted by arrogant customs officers, airline police, vengeful Paris bellhops and opium-fogged Pakistani cabbies was entirely cosmetic. I even kicked the machine over accidentally on two occasions, and yet it still works fine.

What can we look for in the more distant future – say, ten years from now? Voice-activated computers capable of automatically transcribing hours of interviews with either a Georgia farmer or a Boston bank president? Battery-powered portable computers weighing five pounds or less capable of transmitting articles over short-wave bands from remote world hot-spots to a waiting host in a nearby city for relay to newspaper offices continents away? As a journalist, I look to the computer technology field with great hope and expectation.

Who knows, we may even get a portable computer capable of stopping a Russian bullet!

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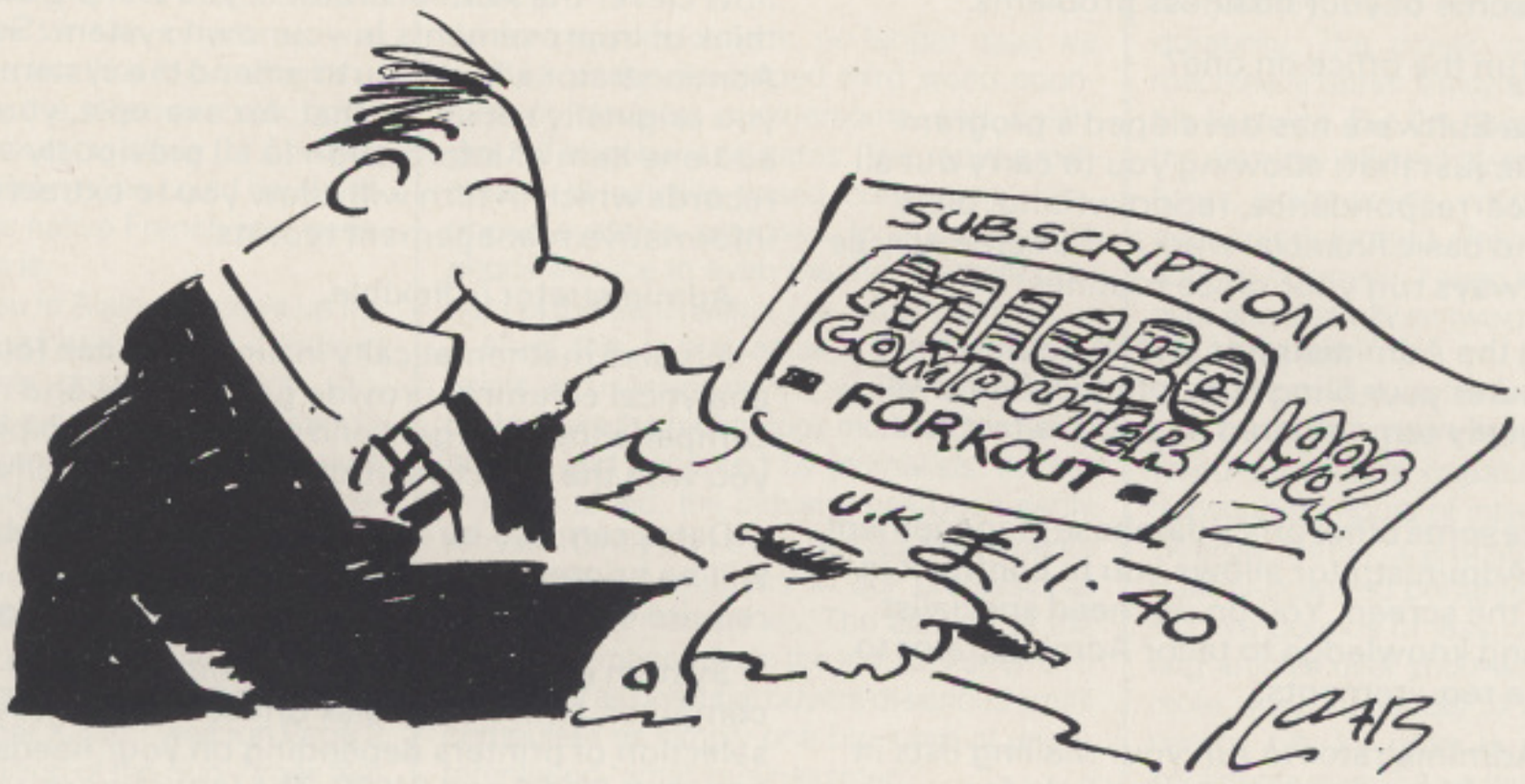

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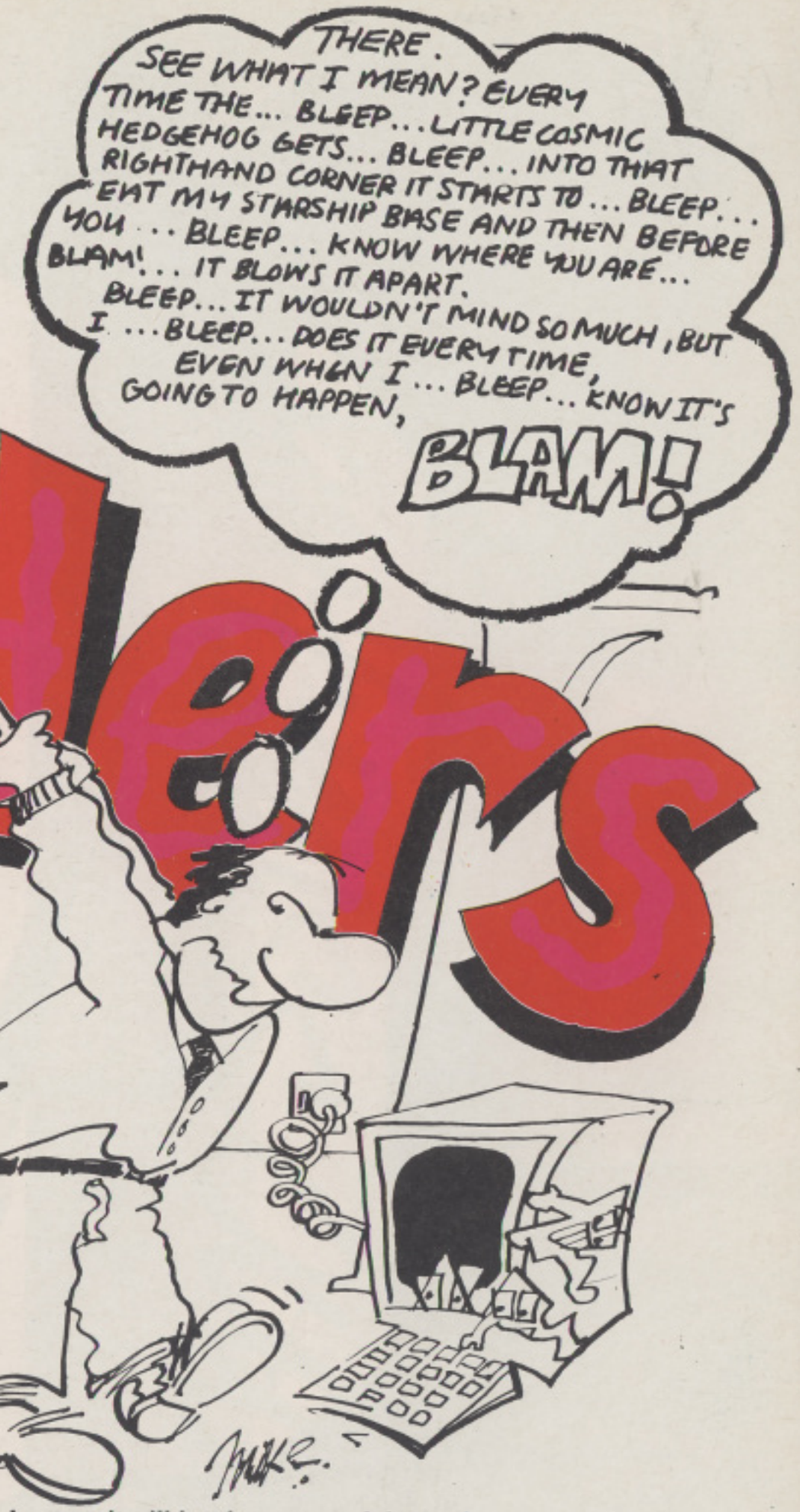
How to win at Space Invaders



BY RICHARD NICHOLS.

It all...bleep...started on a cross...bleep...channel ferry, sometime in the late...POW...got the swine...seventies. We were just...bleep...minding our own business, checking out safety precautions in the bar, when we...bleep...heard this strange bleeping noise.

'Bleep', we thought...bleep...to ourselves, 'what does bleep mean?'

Soon...bleep...found...BLAM! 20p down the drain again...out what it was. Space Invaders, that's what.

There's no doubt about it, Space Invaders was the game which launched a thousand microchips, and put the arcade video boom into intergalactic orbit for good and ever. Within months it was driving everybody crazy. Every tinpot sociologist in the country was appearing on the box telling anxious parents how Space Invaders could turn eight-year-old kids into drug-crazed sex fiends with a marked proclivity for mugging old ladies, and all in a matter of hours.

'Does playing Space Invaders make you blind/impotent/stupid/vote SDP?' asked banner headlines. The answer, of course, is 'yes' in all cases, especially if your parents are Liberals. Or Traffic Wardens. Or sociologists.

And if you think it drove Britain crazy, then you should have seen what happened in America. And if that wasn't enough you should know about Japan, where the advent of Space Invader machines created a national shortage of the 100-yen coin. All over the world people were trying to defeat the implacable green monsters before they got to the bottom of the screen and munched up the laser bases faster than the bloke next door can drink your last bottle of 12-year-old malt.

Mystery Ship. It does nothing dangerous, this, which makes a change, but it is worth anything between 50 and 300 points if you manage to hit it. Well worth having, if you can manage it, and you must, because it is the key to a high score at this game.

Adrenalin

Aside from those adrenalin-filled moments when you are killing the obnoxious green jobs like fury, you should think a bit about the game. Like all video games, of the arcade or drive-yourself-crazy-in-the-privacy-of-your-own-home variety, it works on a simple program and therefore does elementary and predictable things. People forget that in the heat of the moment, and panic. Then – BLAM!

Rule one, then – don't panic.

Rule two – trust me. I've been cheating, and consequently know things you don't.

Rule three – shoot the Mystery Ship.

Rule four – stop the green things from coming to get you.

All of which is easier than you think. For a start, you're cleverer than any damn machine, right? Second rule may be harder. Third rule is easy. If you kill a whole rack of 55 green

make the last green thing you kill one from the bottom row, not the top. You have to shoot round them to do this, but it's not as hard as it sounds. If the last one to die came from the bottom row it will, instead of just disappearing, blow up in a trail of green and white phosphoresence, like a two-tone rainbow. Very pretty. Don't be overawed by it, though, otherwise you will still be standing there with a soppy grin on your face when the next rack of hairies starts pounding your laser base with bombs.

And after Space Invaders, what next? Galaxian? Or Moon Cresta, which is the game with cosmic hedgehogs, intergalactic frankfurters and purple stratospheric suppositories? Plays lovely tunes, though.

Or Asteroids?

Reckoned by some to be the best of all the arcade games, Asteroids is big money. Currently reckoned to be the top-earning video game in the world (it toppled Space Invaders in 1980), Asteroids machines swallowed more money – 800 million dollars – in one year of operation than Gone With The Wind has taken in 40 years of box-office success.

Asteroids was conceived in 1978 by Atari

killed, because it will just hang around the screen firing lasers in all directions until it is dispensed with. POW! Feels good, huh?

Don't get excited though. The other saucer, due right along here at any second, is a real evil device. It thinks, you see. It hunts you. And it aims at you, unlike the other one. It's also worth 1000 points, which means high-scorers have got to hunt the saucer rather than hang around in the middle waiting to be blown

The way to lure the saucer out is to save a few big rocks. Because if you wipe out all the

world people were trying to defeat the implacable green monsters before they got to the bottom of the screen and munched up the laser bases faster than the bloke next door can drink your last bottle of 12-year-old malt.

Unlike hulahoops, deely boppers, skateboards and the SDP, Space Invaders was not just a passing fancy. Rather than dying a rapid and expensive death, the machines proliferated. You couldn't go into a pub, fish and chip shop or supermarket without hearing that insidious bleeping beckon you over to have one last chance at nailing the perishers. We all wanted to stick it to them good and proper.

Human nature

The reason the game didn't lose its appeal was that as soon as you had wiped out a screenful of green things, another lot appeared, meaner and faster than the first bunch. And once they'd been flushed down their little electronic pan loads more of them turned up. Fact of the matter is that you can't win, which is why you keep trying. This is all down to the perversity of human nature and explains why so many people still watch *Crossroads* even when they know it isn't going to get any better.

The game is simple enough, and most people know that already. You get 55 Invaders in 5 rows of 11 across the top of the screen. They march inexorably from right to left. When they reach the edge of the screen they start going back the other way, but one row lower down. Each time they get to the edge and drop down they get nearer to your three bunkers at the bottom of the screen. And when they reach them they eat them away. When there are no bunkers left, the game is over and you have been overrun. BLAM!

In order to stop them doing this you have three little laser bases which you can move from side to side of the screen beneath the bunkers, firing upwards at the invaders. With luck you can blow them all up before they reach the bottom and blow *you* up. The bottom two rows are fat things worth ten points when you kill them. The next two are slimmer and worth 20 points each, while the top row of pointed items are worth 30 points a head.

And don't think that they're just going to sit there while you pick them off in droves. They drop bombs all the time. Loads of them. If a bomb hits your laser base then – BLAM! You only get three lives....

Which is where the bunkers come in. Most people hide behind them and dodge about a bit, waiting for the inevitable moment when they land on your head.

And then, as an added thrill, there's the ing to get you.

All of which is easier than you think. For a start, you're cleverer than any damn machine, right? Second rule may be harder. Third rule is easy. If you kill a whole rack of 55 green things you get 990 points. If you shoot four Mystery Ships at the right moment you get 1200 points.

So when you press the button and the machine starts – you start. Killing green hairy items. Kill 22 of them. Press the fire button as fast as you can, but count your shots. Stop after 22 and move to the nearest screen edge and wait. The Mystery Ship will appear, like clockwork, after 22 shots. If it's on the same side of the screen as you, shoot the minute it appears. If it's on the other side wait until the edge of it is just above the edge of your laser base. Then kill it.

If you knock it out with shot 23 it will score 300. Fire another 14 shots. The ship will appear again. Hit it with the fifteenth and you get another 300 points. From now on the ship will appear every 14th shot and you must hit it with your fifteenth to score 300.

While you are doing all this the green invaders will be dropping bombs and getting nearer to you, descending row upon horrid row. It is not safe to ignore this, since you know what the result will be; BLAM! Stopping them is easy. Doesn't wipe them out, though. As long as they are still there you will get lots of Mystery Ships to score points from. What you must do is slow their descent. Since they only drop down a row when they touch either edge of the screen the simple trick is to wipe them out in vertical columns from one side; left is probably easier since that is where your laser base starts from. Bang off four columns and they'll take ages to get from one side to the other.

Real experts

Also you should know that the bunkers are more of a hindrance than a help. They restrict your firing more than they protect your laser base, so don't worry about knocking them out with spare shots while you're waiting for your next 300 points to swan along.

And it may be of help if you realise that when they do sink down, the invaders on the last level before they start munching the bunkers do not drop bombs on your laser base. They'll drop them anywhere else, but not on you. You may hide under them or kill them with impunity, but remember to get out from under if you shoot them, because the swine in the next row up will immediately drop a bomb on your head.

Real experts at the game already know the bonus with this game. If you can arrange it, in 1980), Asteroids machines swallowed more money – 800 million dollars – in one year of operation than *Gone With The Wind* has taken in 40 years of box-office success.

Asteroids was conceived in 1978 by Atari engineer Lyle Rains as a game in which the player pilots his ship through a 'wraparound' moving field of space rocks. Fellow-engineer Ed Logg added 'enemy' flying saucers and Hyperspace and wrote the long, complicated program which put the game on the screen.

Like Space Invaders, however, it is still entirely predictable in most areas of operation. The object is not to be hit by flying space rocks. Avoiding them, via the rotate right/left and thrust controls, scores no points. Shooting them does. The player's ship can only have four shots on screen at any time, and so most people fire in bursts of four.

Space rocks

Space rocks come in three sizes – large, medium or small. Big ones, when hit, divide into two medium ones which become two small ones when hit. Small ones disappear when they are shot. The Asteroids computer can only deal with up to 27 rocks on the screen, so if the display is full and you hit a large or medium rock it will disappear completely. The first rack of rocks has four big ones, the second rack – you should be that lucky – has six, the third eight and the fourth and all succeeding racks has ten.

Rocks must always be hit in the centre, or as near to it as you can, as this impact will cause the resulting fragments to move away from your spaceship at a nice slow space, which makes for good shooting.

And it makes sense to stay near the centre of the screen if you can; you have a better chance of seeing the overall position and having time to act. Close to the edge, your ship can be fragmented by a rock almost before you see it coming. Because if a space rock hits your ship, you *know* what will happen. Correct. And BLAM! again. The slow disintegration of your ship – first used in Lunar Lander – has been known to make grown men weep.

In among the rocks come occasional visits from Ed Logg's flying saucers. The first type is a fairly large one which beetles about in a random pattern, firing lasers off indiscriminately in all directions. If you're unlucky one of its shots will hit your...BLAM!...spaceship. Therefore you clearly have a responsibility to shoot it before the inevitable happens.

This is best done from as far away as possible. The closer you get to the saucer, the narrower the angle of fire it needs to cover to hit you; you're a lot safer at a distance, simply by the law of averages. This saucer must be scorers have got to hunt the saucer rather than hang around in the middle waiting to be blown up. BLAM!

The way to lure the saucer out is to save a few big rocks. Because if you wipe out all the rocks you just get a new rack and a new set of complications. So save some rocks. You score more shooting saucers than you do killing rocks. And small ones are useless for hiding behind.

Drift down to the lower half of the screen, and hang about near the edge. The small saucer usually appears nearer the top, and the minute it shows up, you must start shooting. If it's on the same side as your ship, bang off four shots and then move, before it's had a chance to aim. Keep firing and moving, and keep hiding behind the rocks. Remember that you can fire wraparound shots to either side or up and down, so you can put a rock between you and the saucer and then shoot it in the back.

In cases of dire emergency you should activate the Hyperspace button. But only dire emergency. Borrowed from the film *Star Wars*, this control causes your spaceship to vanish from the screen temporarily and reappear in another, random location. One time in four that other location will be in front of a large rock which is on the point of demolishing whatever is in its path. In this case, you. You know what will happen...

To give yourself a chance you should keep pounding the 'fire' button while you are in Hyperspace, and keep rotating the ship in one direction. That way, when it reappears, you'll at least stand a chance of clearing the impending doom out of the way. This technique is also useful when you clear a whole rack of space rocks from the screen; there's always a delay before the next lot shows up, and it will be to your advantage to have the maximum four shots on the screen at all times until they appear. At least you stand a chance of hitting *something*.

There are rules for all video games. Pac-Man, Defender, Sea Wolf, Galaxian, Death Race, Space Wars, Missile Command, Scramble, Space Battle and even Gorf. There are even different rules for the domestic games, most of which are slightly different to the arcade versions. You, being the perspicacious chap you are, will already have noticed that these rules are not present in this feature.

If you'd like to know them then you may, if you wish, cheat the same way I did. Read all 270 pages of *The Winner's Book of Video Games* (Star Books, £2.50) by an American gent name of Craig Kubey, and then go out and start giving the green wossnames the pasting of their life...bleep...bleep...bleep... BLAM!

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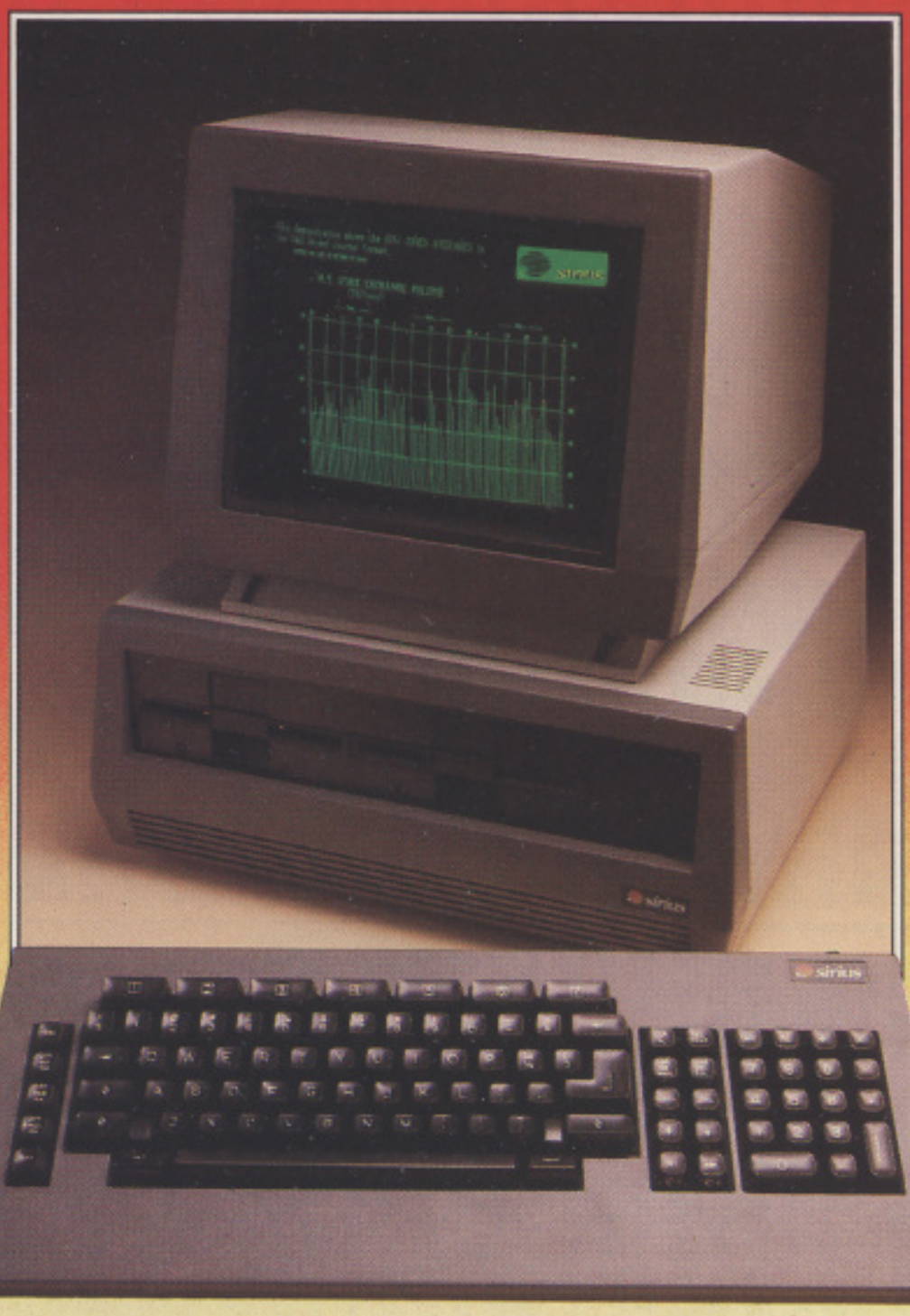

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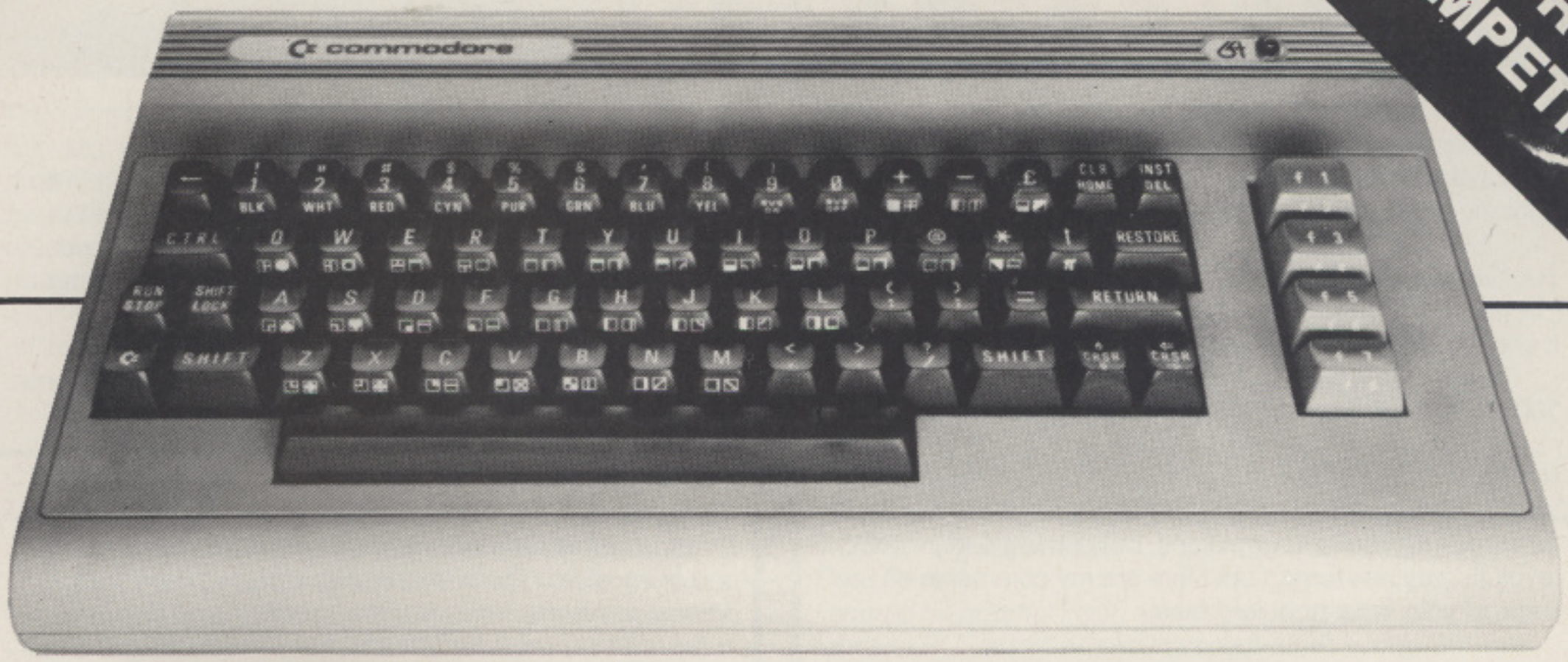

WIN A COMMODORE 64

Due to be launched this month, the Commodore '64 is the first of a new generation of home computers.

In outward appearance, the '64 looks much like the VIC-20 from which it has obviously been derived. Internally, however, it sports 64K of RAM (of which 38K is available to the BASIC programmer) – which makes possible all manner of sophisticated video games, as well as most business applications. The price, incidentally, will be £299 + VAT.

VIC's 22 column screen has, thankfully, been upgraded to a handsome 40x25, with 16 colours, and high-resolution graphics up to 320 x 200 poinnts.

But most interesting are the 'Sprite' graphics – pioneered by Texas and Atari. 'Sprites' are colourful, graphic objects which can be designed by the programmer and then moved about the screen at will, using simple commands. There is even a 'collison detection' routine which detects when sprites collide – ideal for writing space-fight games. Sprites can be assigned to one of eight planes on the screen, so that they can pass in front of or behind other objects – giving a 3-dimensional effect.

And on the sound front things have changed too, with the addition of SID – a Sound Interface Device. Instead of restricting you to simple bleeps and tones, SID has all the facilities of a small synthesiser. The technical term is 'full envelope control' – meaning that you can control the attack, delay, sustain, and release of any note played. Eat your heart out, Mike Oldfield!

We shall be awarding one of the first Commodore '64s to be built to the reader who can come up with the most original and useful idea for a program to run on a home computer such as the Commodore '64. All we want is the *idea* – no listings, no cassettes – just a *maximum* of 200 words describing your program.

The idea must be original, must be for one program (not a suite of programs), and should be applicable to as many people as possible. The program does not have to make use of any or all of the '64's features, though bear in mind that we are looking for a step forward in home computing. The program should be for use in the home – but may be for education, entertainment, home management, or running a small business from home. Here are a few suggestions:

- A simple game which teaches young children to create musical sounds.
- A program which calculates the best way to cut down the heating bill.
- A word processor which points out grammatical errors!
- A sound-to-light converter that links into your hi-fi.

The judges will be taking feasibility into account but don't let the fact that no-one has yet written such a program put your off.

All entries should be submitted (preferably typed) to:-

Commodore Competition
MicroComputer Printout
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enclosing the entry coupon. Closing date is October 11th 1982. The judges will be John Baxter, Marketing Manager of Commodore UK Ltd., and Richard Pawson, Editor of MicroComputer Printout.

COMMODORE 64
COMPETITION
ENTRY COUPON

One entry only per family, please, and be sure to include this coupon. We regret that entries cannot be returned.

TOMMY'S TIPS

Full marks for Mr. Leif P. Anderson, who pointed out an error in a recent Tommy's Tips (Shock Horror Probe). in demonstrating how to test for the space bar being pressed, I got my conditionals in a twist. The incorrect line was:

```
100 GET A$ : IF A$ = "    " THEN 100
```

It should, of course, have read:

```
100 GET A$ : IF A$ <> "    " THEN 100
```

Replies have been pouring in for the competition for the best addition to BASIC. Congratulations to all and sundry for some interesting suggestions, but nothing *really* revolutionary has turned up. Here are my comments on some of your most popular ideas.

"A BASIC without garbage collection" – try the later PET models.

"The ability to say GOTO X, where X is a variable". This facility is provided in FORTRAN, after a fashion, but should not be necessary in BASIC, and I must say I am not too keen on it. If you cannot do what you want with the ON ... GOTO and ON ... GOSUB statements, then you are not holding your data efficiently. For example, say you have a variable X which has a series of possible values 0, 15, 237, 34 and you want to test which value you have and jump to a line number accordingly. You could not use these values as they stand in an ON X GOTO statement, but if you held the possible values in an array X( ), you can say:

```
100 J=0:FOR I=1 TO 4:IF X =X(I) THEN J=I:I=4
110 NEXT I
120 ON J GOTO 200,210,220,230
130 PRINT "X HAS ILLEGAL VALUE" : END
```

The reason I do not like the assigned GOTO is that if you are trying to debug a program and you come to a line:

```
100 Y = 1245+PL%*5−100*(X=5)−250*(X>6)−350*(X=0)
110 GOTO Y
```

it can take some head scratching to work out exactly where the program is going when X=14.2 !

A big raspberry for all those readers who wrote in saying "Who needs a SAVE and RUN?", and suggesting a program line like:

```
63000 SAVE "FRED"
63010 RUN
```

My point is that yes we can do without a SAVE and RUN feature, we can also do without FOR loops, ON ... GOTO, Pirelli calendars, Chateau Lafitte '29 and lots of other trifles, but they do make life that little bit more civilised!

One interesting suggestion came from Mr. Ajay Kanabar is that we could have "variable variables" in the same way that the assigned GOTO above is a "variable GOTO". We might say:

```
10 X$= "A$" : REM SET UP VARIABLE NAME IN X$
20 {X$}=154 : ASSIGN VALUE TO VARIABLE
```

As it stands, I do not think this has any advantage over normal BASIC arrays. To make it useful, we need to go to the sort of facility provided in ALGOL and PASCAL, which is very useful for building complicated data structures such as heaps and various kinds of trees. This is the ability to create and delete variables during the program run, and manipulate them by means of pointers (like array subscripts) and pointers to pointers etc. This system also handles Mr. Kanabar's second suggestion, which is the provision of statements to manipulate stack and queues. However, to get the full benefit from this system, we need many other changes to BASIC, and might as well go straight to a structured language such as PASCAL.

So put your thinking caps back on and think up some *really* revolutionary changes for BASIC.

Driving accident

Dear Tommy,

I had an unfortunate accident with my 4040 disk drive and one of my disks. The accident was that the power jumped off and on several times in a few seconds and I was unable to turn off the computer fast enough. I frequently get these short power outages here in the 'boondocks'.

The disk now, after trying to read it, gives the error message, "23, READ ERROR,18,07". I wonder if you know of a way of overwriting this disk area, so that I can make a duplicate and save the information I need.

Any information on how to recover from this accident would be appreciated.

John J. Schueler,
Arizona

The error message you are getting means that the disk unit is getting a checksum error when it tries to read track 18 sector 7. The checksum is a pair of bytes written at the end of each sector, calculated from the data as it is written to the sector. When the sector is read back, a checksum is calculated from the data read and compared with the checksum on the disk. If they are different, then an error has occurred. In your case, one or more of the data bytes in the sector has been overwritten during the power failure, so that the checksum no longer agrees with the data on the disk. Track 18 sector 7 is part of the disk directory, so even if we can get the sector back, you may well have lost some files.

The first thing to try is to copy the corresponding sector from a *blank* disk, using the U1 and U2 commands:

```
100 OPEN 15,8,15
110 OPEN 1,8,3,"#"
120 PRINT #15,"U1:";3;1;18;7
130 PRINT #15,"U2:";3;0;18;7
140 CLOSE 1 : CLOSE 15
```

If this does not work, because the disk is more seriously corrupted, you will have to follow this procedure:

1. Copy every sector from the damaged disk to a blank disk using U1 and U2. Use the error messages from the disk to test for damaged sectors.
2. Use the Validate command to tidy up the disk, freeing any sectors allocated to files which have been lost due to the damage to the disk directory.

Even after all this, you ought to check your files in case some data has been lost or altered.

Keyboard matters

Dear Tommy,

There is a table which converts the keyboard matrix to ASCII. The address in BASIC 1 is $E73F, can you tell me what the address is in BASIC 4 as it is not on any memory map I have.

Ian Hamilton

The location of this table does tend to move about a bit between the various machines which use BASIC 4. I have an 8032, where the table starts at $E6D0, and an old (non-Fat-40!) 4032, where it starts at $E60A. However, if any readers have machines with different variations, they will no doubt deluge me with letters, so I will keep you up to date with them! By the way, the keyboard is decoded somewhat differently in the 8032, so you should bear this in mind if you are writing any programs which look at the keyboard directly.

Chain letter

Dear Tommy,
I want to chain programs together enabling sub-programs to be called from the master and the master to be called from the sub-programs. In your July 1981 issue in a piece called, "Pulling the Chain", you offered a solution which I have tried but it does not seem to work. It seems to successfully load the program but it doesn't run. It either hangs or crashes with error message "string too long" or "out of data".
Can you help?
Alan Johnson

This is what you do. First, load all the sub-programs you want to chain, and PEEK at the values in 42 and 43 to find the largest. Remember that the end of program is PEEK(43)*256 + PEEK(42). Now if your master program (that is the first program to be loaded, the one you actually key in DLOAD "FRED") is larger than all of these, then you can chain quite happily by just using a line such as:

```
1100 DLOAD "PROG2",D0
```

However, let us assume the worst (and your master program may only be a short menu program taking only a couple of kbytes). What you need to do is to con BASIC into thinking that the master program is larger than it really is. Say that the largest sub-program gave the following values:

PEEK(42)=15 PEEK(43)=70

At the very start of your master program, insert a line saying:

```
1 POKE 42,0 : POKE 43,72 : CLR
```

If you use the formula above, you will notice that I have left quite a bit of room. This is because the sub-programs are bound to grow a bit as you make changes to them, and this saves having to alter the main program every time you edit one of the others.

You should now be able to chain from one program to another quite happily, because BASIC thinks, after line 1, that the master program is the largest in the suite.

Two words of warning. When you have found a bug and you want to alter a program, *always* load a fresh copy manually, *never* save a copy which was chained to by the program. If you don't, you will save a bigger program than you think (the size of program saved is defined by the locations 42 and 43) and you will have to alter your main program again.

The other minor program refers to string constants. Say you have a program line which says:

```
10 P$="TITLE PAGE"
```

You should replace this with:

```
10 P$="TITLE "+"PAGE"
```

This is because, in the first case, BASIC uses the data "TITLE PAGE" from the program test itself. Once the program is overwritten by the next program in the suite, the string data will be lost. In the second case, a string calculation is involved, so the data for P$ is stored in string space at the top of memory. You do not need to do this with strings read from DATA statements, or INPUT from the keyboard, or calculated in any way, such as P$=LEFT$(AS$,5), so you will probably find that only a few strings are affected.

POSitively useless!

Dear Tommy,
I should be grateful if you would give examples of how the function POS is to be used in programs.
M.P. Wong

As I have said before in this column, I personally do not see the need for the POS function in a well-written program. It is used (I presume, because in over ten years of BASIC programming, I have never actually used this function myself) while printing a line of text, to work out how far across the screen you are. Some BASICs have an LPOS function which does the same thing for the printer. This would come in handy when you are trying to present data in a series of columns across the screen. However, I have a series of special subroutines which convert numbers to standard strings (say 10 characters long, two decimal places, leading minus sign). This means that at any time, I know exactly where I am on the screen. However, more powerful BASICs with a built-in PRINT USING statement for formatting output still have a POS function, so maybe there is some use for it which I have not noticed. I suspect that it is only included to give compatibility with old BASICs.

However, here is an example of a use of POS to test if there is room left on the current screen line to print the string Z$:

```
1000 IF POS(0) <= 39 - LEN(Z$) THEN PRINT Z$
```

Keeping TABs

Dear Tommy,
I have an Apple with a Z80 softcard, which I usually program in MBASIC because of its greater power compared with Applesoft. I have noticed that the TAB function allows an argument up to 32768! Is there any use for a tab greater than 80 (the width of my screen), and if so could you clue me up on it?
B. Williams

MBASIC is slightly different to the Applesoft and PET BASIC, in that it allows the argument of a TAB to go up to 32768, instead of 255. On MBASIC, the argument is treated modulo 80 (or 40 if a 40 column screen), so that TAB(85) is TAB(5), TAB(92) is TAB(12) and so on. On Applesoft and PET BASIC, TAB(81) produces a TAB to column 1 on the next screen line; TAB(170) to column 10 on the next line and so on. In fact, these large TABs are not much use, it is just that BASIC does not bother to test if the TAB argument is greater than the screen width.

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Chuck Peddle, Inventor of the PET

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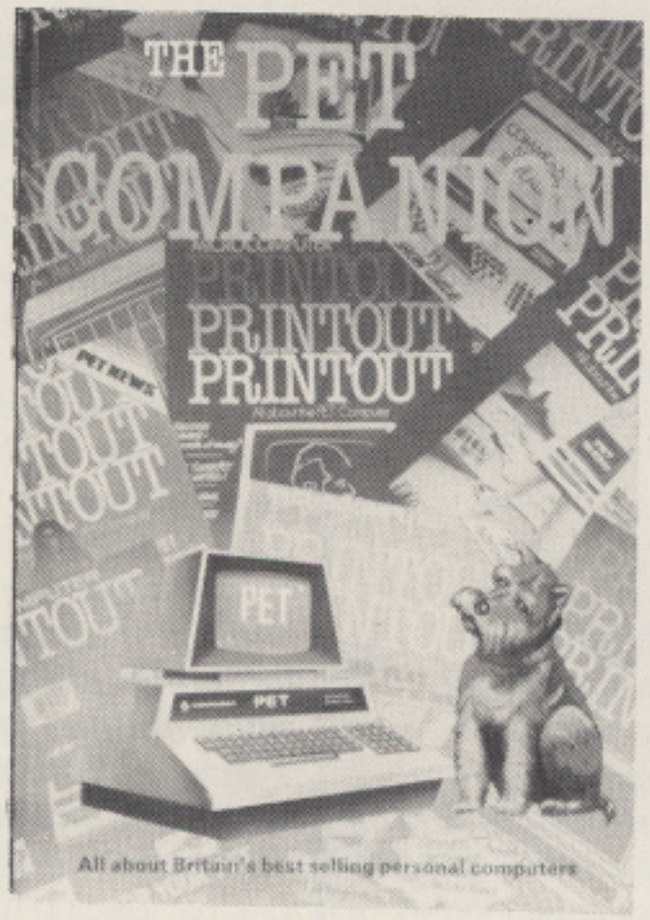

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ZX Spectrum

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EDIT	CAPS LOCK	TRUE VIDEO	INV. VIDEO	⇦	⇩	⇧	⇨	GRAPHICS	DELETE	
1 !	2 @	3 #	4 $	5 %	6 &	7 '	8 (	9)	0 _	
DEF FN	FN	LINE	OPEN #	CLOSE #	MOVE	ERASE	POINT	CAT	FORMAT	
SIN	COS	TAN	INT	RND	STR$	CHR$	CODE	PEEK	TAB	
Q ⇐ PLOT	W <> DRAW	E >= REM	R < RUN	T > RAND	Y AND RETURN	U OR IF	I AT INPUT	O ; POKE	P " PRINT	
ASN	ACS	ATN	VERIFY	MERGE	[	]	IN	OUT	©	
READ	RESTORE	DATA	SGN	ABS	SQR	VAL	LEN	USR		
A STOP NEW	S NOT SAVE	D STEP DIM	F TO FOR	G THEN GOTO	H ↑ GOSUB	J − LOAD	K + LIST	L = LET	ENTER	
~	|	\	{	}	CIRCLE	VAL $	SCREEN $	ATTR		
CAPS SHIFT	LN	EXP	LPRINT	LLIST	BIN	IN KEY$	PI			
	Z : COPY	X £ CLEAR	C ? CONT	V / CLS	B * BORDER	N , NEXT	M . PAUSE	SYMBOL SHIFT	BREAK SPACE	
	BEEP	INK	PAPER	FLASH	BRIGHT	OVER	INVERSE			

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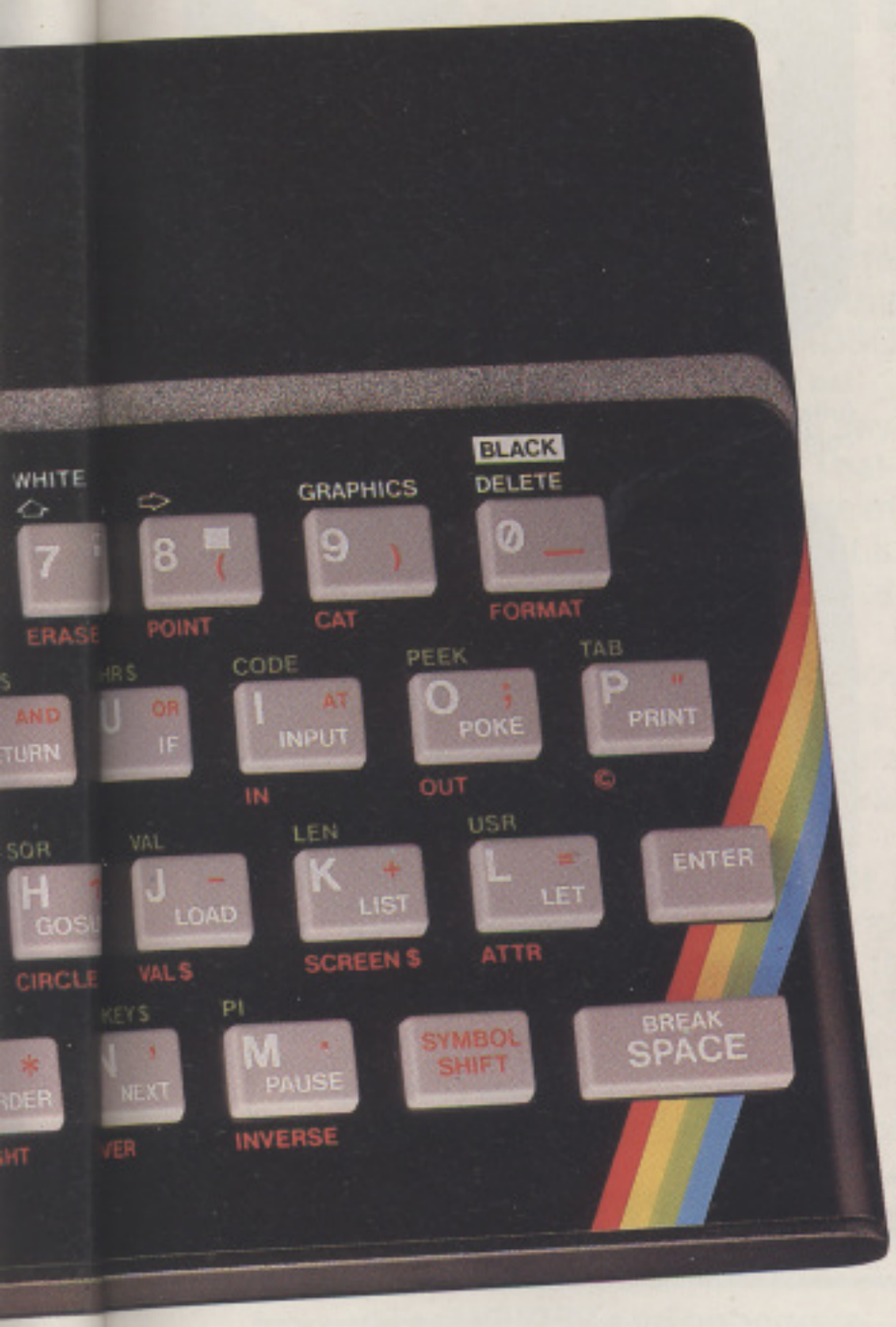

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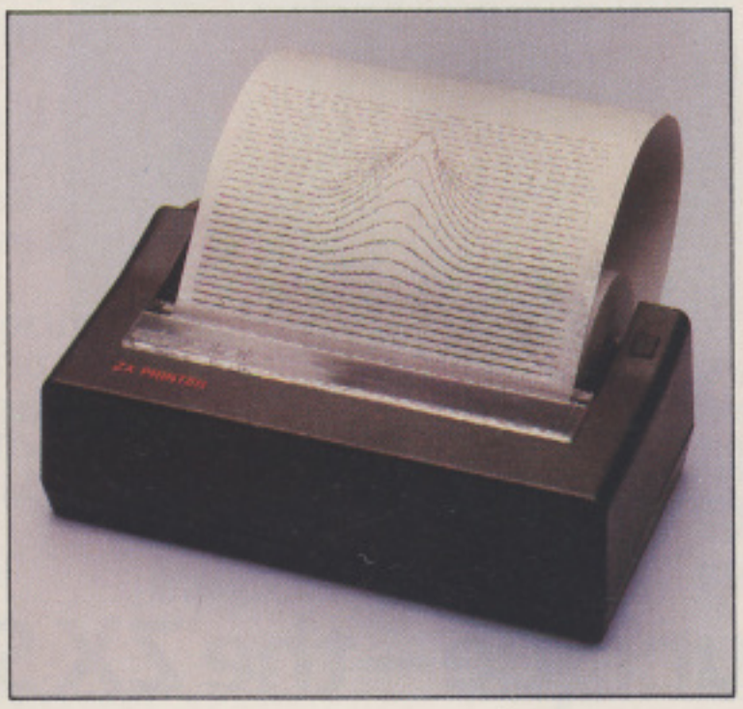
The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microfloppy.

The transfer rate is 16K bytes per second, with average access time of 3.5 seconds. And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum.

All the BASIC commands required for the Microdrives are included on the Spectrum.

A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.



How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard, Access or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

RS232 / network interface board

This interface, available later this year, will enable you to connect your ZX Spectrum to a whole host of printers, terminals and other computers.

The potential is enormous. And the astonishingly low price of only £20 is possible only because the operating systems are already designed into the ROM.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. **Order**

Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
			Total £	

Please tick if you require a VAT receipt ☐

*I enclose a cheque/postal order payable to Sinclair Research Ltd for £ _____

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable

Signature

PLEASE PRINT

Name: Mr/Mrs/Miss

Address

MPP 810

FREEPOST – no stamp needed. **Prices apply to UK only.** **Export prices on application.**

ZX Spectrum

Available only by mail order and only from

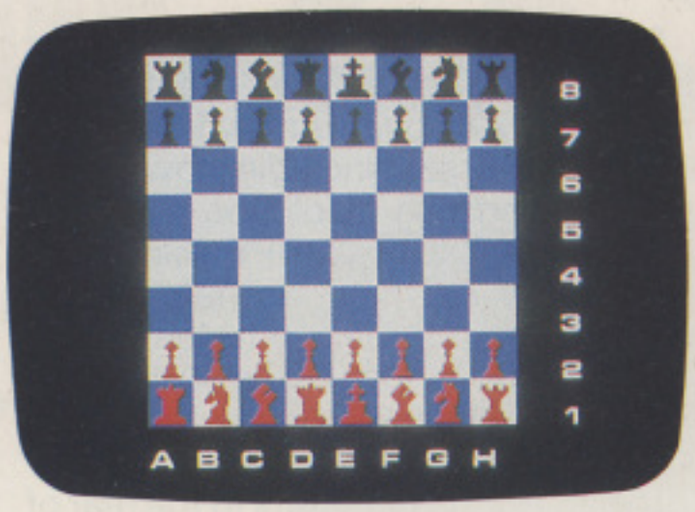
sinclair

Sinclair Research Ltd,
Stanhope Road, Camberley,
Surrey, GU15 3PS.
Tel: Camberley (0276) 685311.

ZX Spectrum software: how good and how soon?

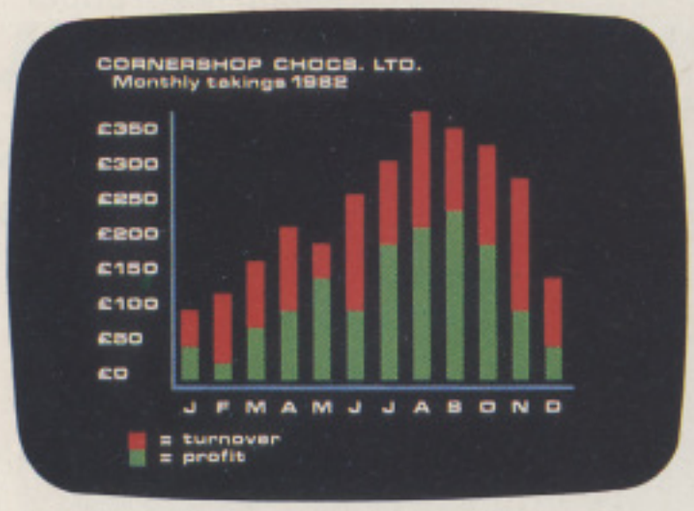
The ZX Spectrum uses an enhanced version of Sinclair BASIC, fast becoming a world standard, and unlikely to be superseded. Unique features, such as one-touch keyword entry and syntax check and report, are increasingly attracting software originators.

Building the software library is already far advanced, and a complete catalogue will be available in the next few months. Subjects will include sophisticated games, education, 'housekeeping', and business management. The more complex packages can, of course, be used to their best advantage with the full 48K RAM version of the ZX Spectrum.



The Sinclair ZX Spectrum can handle sophisticated games programs with high-resolution colour graphics and sound.

This major advance in computer technology maintains Britain's world-beating position in the field of personal computers.



A range of business software will soon be available, covering both specific applications (eg stock-control and payroll) and general business management systems (eg matrix models).

This second generation of Sinclair personal computers demonstrates continuing commitment. Advanced technology made the ZX80/81 family a price breakthrough: advanced technology makes the ZX Spectrum a breakthrough in price and performance.

Elegant, effective, unique—the ZX Spectrum design.

'Less than half the price of its nearest competitor – and more powerful.'

'These two pictures show how it's done. On the right is the PCB from the BBC Model A Microcomputer. On the left is the PCB from the ZX Spectrum.

'It's obvious at a glance that the design of the Spectrum is more elegant.

What may not be so obvious is that it also provides more power.

'The ZX Spectrum has more usable RAM, and higher maximum RAM.

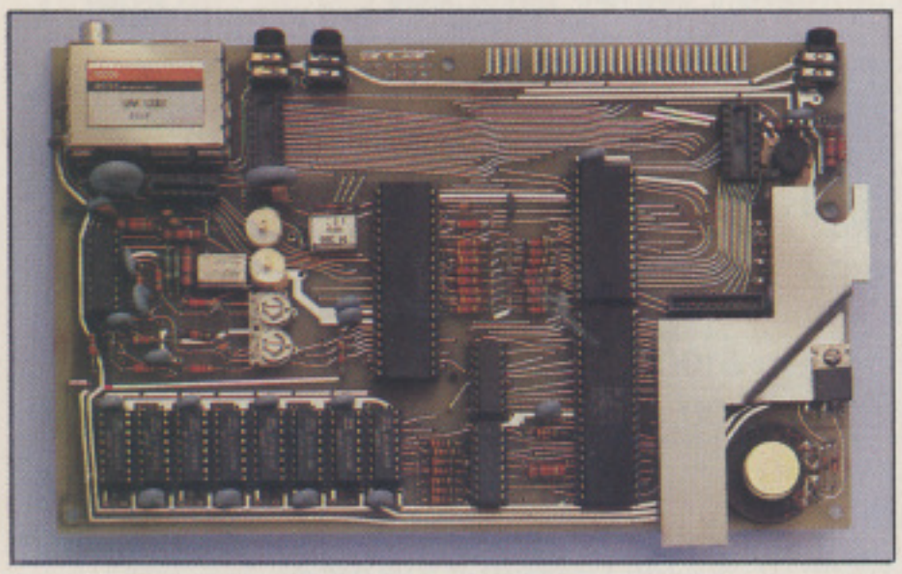
'It offers twice as many colours on the screen at any one time, plus a colour brightness control. It also offers user-definable graphics.

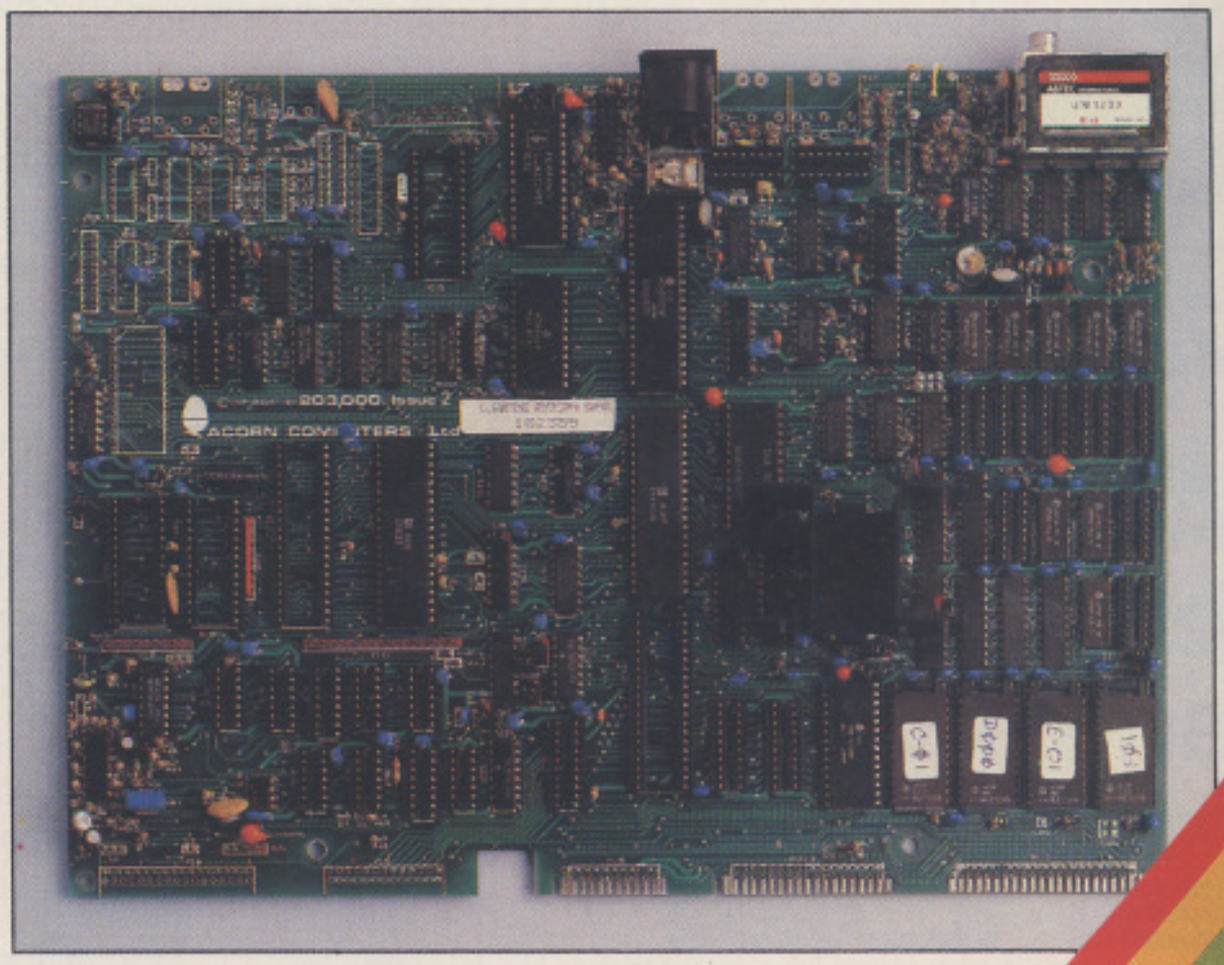
'It has data transfer rate 25% faster, supported by a VERIFY facility.

'And it employs a dialect of BASIC (Sinclair BASIC) already in use in over 500,000 computers worldwide.

'We believe the BBC make the world's best TV programmes – and that Sinclair make the world's best computers!'

– Clive Sinclair.





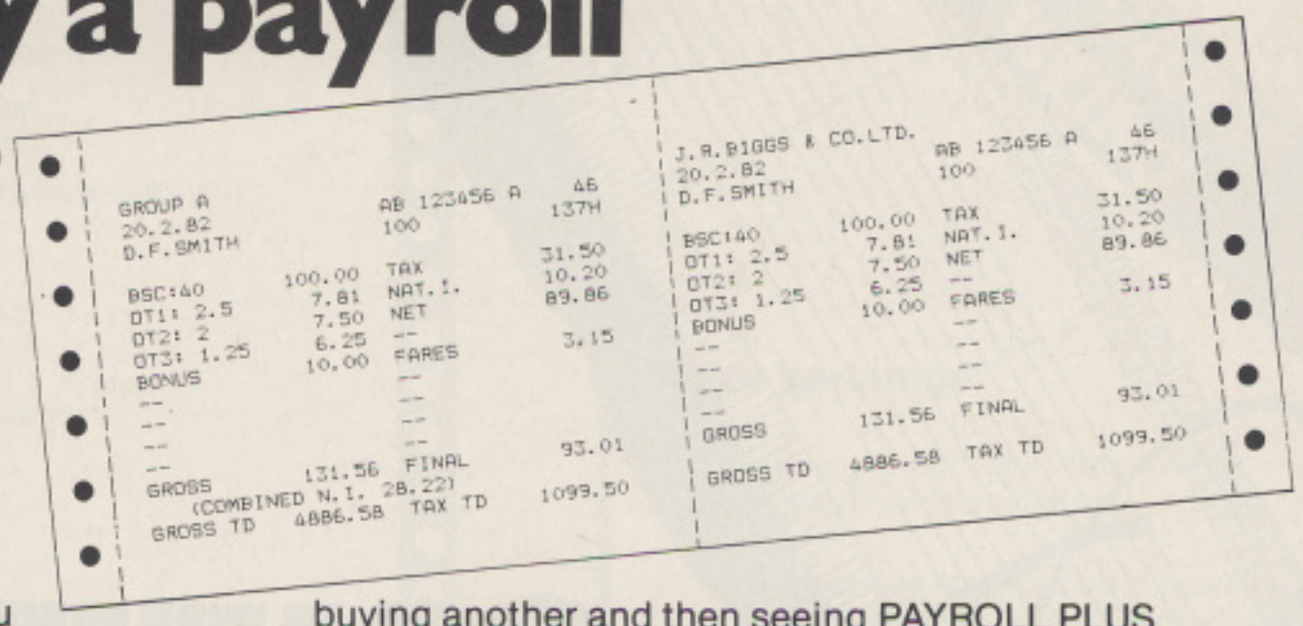
Above left: internal layout of Sinclair ZX Spectrum.

Right: Internal layout of BBC Micro Model A.

The illustrations are to the same scale, and demonstrate the rate of advance in microcomputer design. The ZX Spectrum uses just 14 chips to provide more power and more user-available RAM.

sinclair ZX Spectrum

How to buy a payroll program...



First, go to your CBM/PET dealer and ask to see at least two different payrolls. Second, make sure that one of those you see is the LANDSOFT 'PAYROLL PLUS'.

We are serious when we say you should see more than one. That way you are more likely to find the one most suited to your needs. However good PAYROLL PLUS is, there are certain things it won't do that other payrolls will — and vice versa.

Why do we say that you should insist that PAYROLL PLUS is among those you should see? Because it is so elegant in operation and so extremely easy to use. If you want a payroll that needs an expert 'computer person' to operate it, or if you enjoy spending hours trying to decipher an operating manual then PAYROLL PLUS is definitely NOT for you. You would find it too quick and easy to master.

So don't make the mistake of buying another and then seeing PAYROLL PLUS afterwards. Your awareness of its excellence could then be most frustrating!

PAYROLL PLUS is in use by a number of accountants and even bureaux.

Versions for 8032, 4032 and 3032 series CBM/PET **£150 + VAT.**

LandSoft

The Courtyard, 152-154 Ewell Road,
Surbiton, Surrey.
Telephone: 01-399 2476/7

SUPERIOR PROGRAMS FOR THE CBM/PET MICROCOMPUTER

MICHAEL ORWIN'S ZX81 CASSETTES

The best software (by various authors) at low prices

QUOTES

"Michael Orwin's £5 Cassette Two is very good value. It contains 10 stolid well designed games which work, offer plenty of variety and choice, and are fun."

from the ZX Software review in Your Computer, May '82 issue.

"I had your Invaders-React cassette . . . I was delighted with this first cassette."

P. Rubython, London NW10

"I have been intending to write to you for some days to say how much I enjoy the games on 'Cassette One' which you supplied me with earlier this month."

E. H. London SW4

". . . I previously bought your Cassette One and consider it to be good value for money!"

Richard Ross-Langley, Managing Director, Mine of Information Ltd.

CASSETTE 1

(eleven 1k programs)

machine code:
React, Invaders, Phantom aliens, Maze of death, Planet lander, Bouncing letters, Bug splat.
Basic:
IChing, Mastermind, Robots, Basic Hangman.
PLUS Large screen versions of Invaders and Maze of Death, ready for when you get 16k.

Cassette 1 costs £3.80

CASSETTE 2

Ten games in Basic for 16k ZX81

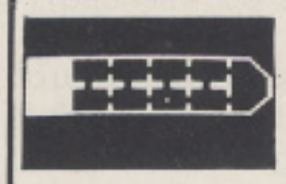
Cassette Two contains Reversi, Awari, Laser Bases, Word Mastermind, Rectangles, Crash, Roulette, Pontoon, Penny Shoot and Gun Command.

Cassette 2 costs £5.

CASSETTE 3

8 programs for 16k ZX81

STARSHIP TROJAN



Repair your Starship before disaster strikes. Hazards include asphyxiation, radiation, escaped biological specimens and plunging into a Supernova.

STARTREK This version of the well known space adventure game features variable Klingon mobility, and graphic photo torpedo tracking.

PRINCESS OF KRAAL
An adventure game.

BATTLE Strategy game for 1 to 4 players.

KALABRIASZ World's silliest card game, full of pointless complicated rules.

CUBE Rubik Cube simulator, with lots of functions including 'Backstep'.

SECRET MESSAGES This message coding program is very txlp qexi jf.

MARTIAN CRICKET A simple but addictive game (totally unlike Earth cricket) in machine code. The speed is variable, and its top speed is very fast.

Cassette 3 costs £5.

CASSETTE 4

8 games for 16k

ZX-SCRAMBLE (machine code)

Bomb and shoot your way through the fortified caves.

GUNFIGHT
(machine code)

INVADERS
(machine code)

FUNGALOIDS (machine code)

GALAXY INVADERS (machine code)
Fleets of swooping and diving alien craft.

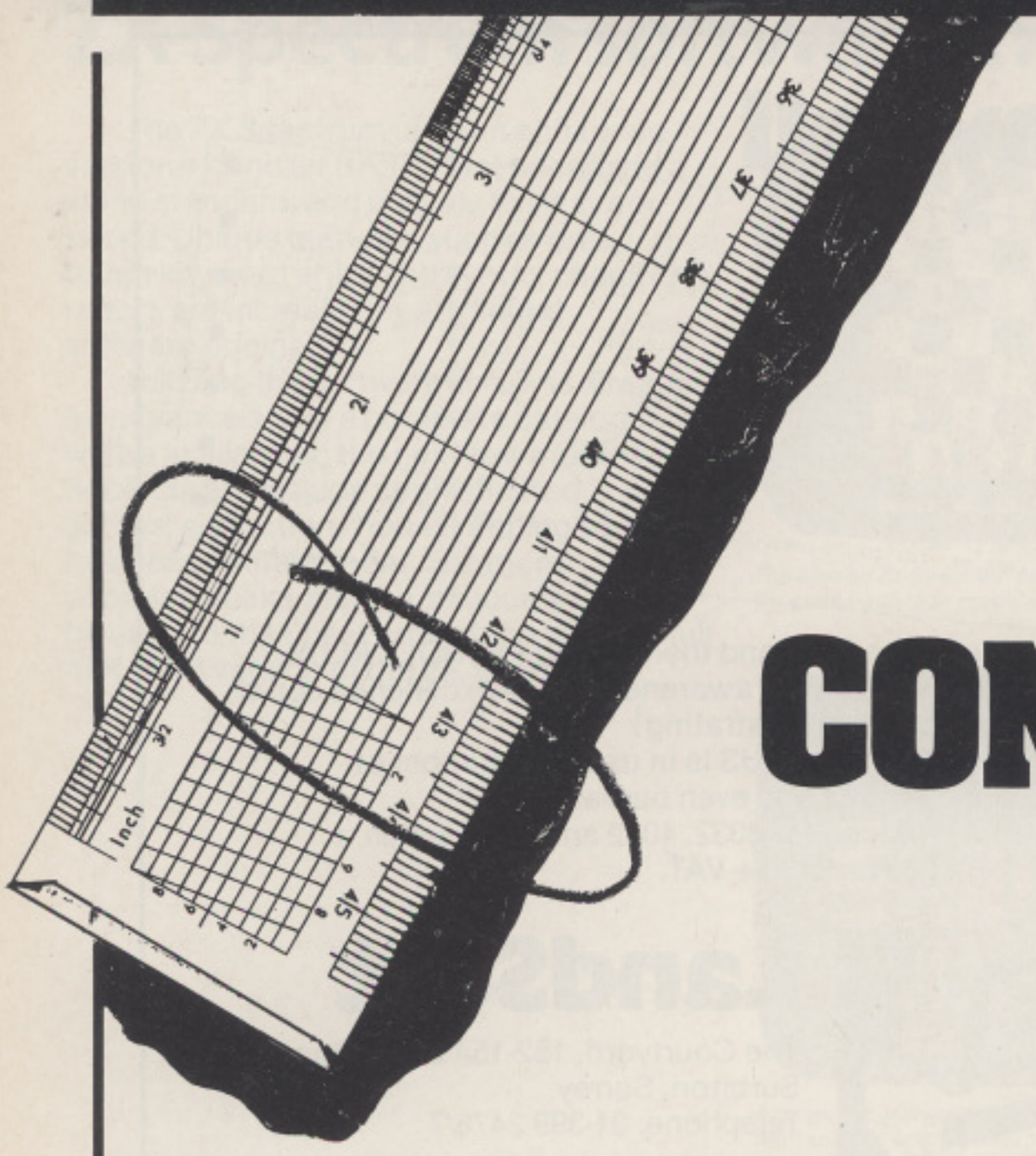
SNAKEBITE (machine code)
Eat the snake before it eats you. Variable speed (very fast at top speed)

LIFE (machine code)
A ZX81 version of the well known game.

3D TIC-TAC-TOE (Basic)
Played on a 4×4×4 board, this is a game for the brain. It is very hard to beat the computer at it.
7 of the 8 games are in machine code, because this is much faster than Basic. (Some of these games were previously available from J. Steadman).

Cassette 4 costs £5.

Recorded on quality cassettes, sent by first class post, from:
Michael Orwin, 26 Brownlow Rd., Willesden, London NW10 9QL (mail order only please)



METRIC CONVERSIONS

A useful program that can save both time and embarrassing mistakes when dealing with imperial and metric measurements. In addition, **Bob Chappell's** listing includes a useful routine for calculating how many rolls of wallpaper you need to cover a room

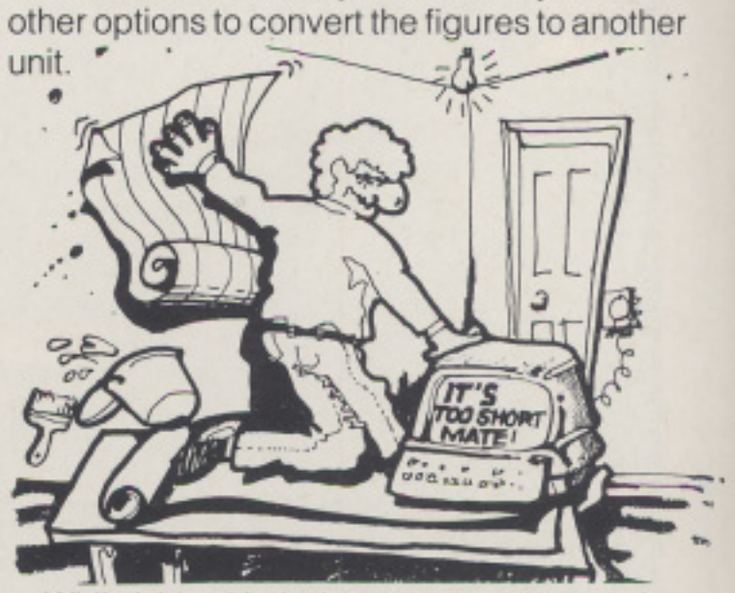
Stephen Leacock had a morbid fear of banks. On entering one for the first time to open a bank account, he was so overwhelmed by the sheer awesomeness of the place, that he became flustered and immediately withdrew the sum he had just used to open his account. He was too ashamed ever to return there again.

If you have ever had a similarly daunting experience in an ironmongers when your request for 1-lb of 2-inch nails was met with a knowing smile and the ego-shrinking reply, "Ah, you really want half a kilogram of 5 centimetre nails, n'est-ce pas?", then shrink no longer, help is at hand. The help in question is a program which will handle most of the conversion from UK standard to metric, and vice-versa, and throws in a useful aid to estimating the number of rolls of wallpaper you need for a job for good measure (no pun intended). tended).

The program first presents a main menu offering conversion from UK to metric, metric to UK, a wallpaper estimating routine, or to end the program. Selecting the first option causes a menu of 18 options (1½ doz) to be presented including inches to centimetres, miles to kilometres, square feet to square metres, cubic yards to cubic metres, ounces to grams, pints to litres, and fahrenheit to centigrade. Having chosen your option (which also allows you to return to the main menu), you are simply asked to enter the amount you wish converted and before you can say EEC, the converted amount, correct to a meaningful number of decimal places, will be displayed. You may then continue on this option or return to the 18 choice menu from whence you came. Selecting the metric to UK menu does exactly the same, only in reverse.

Patchwork quilt

The wallpaper estimator option can help you avoid the embarrassing situation ("Please may I have a refund on these ten rolls I found I didn't need") and the patchwork quilt wall effect ("I'm sorry, sir, we have sold out of that mill number – this one is fairly close.") While making no claims for its precise accuracy, it should help to take a lot of the guesswork out of estimating the number of rolls needed. The program asks you to enter the height of the room being papered, distance around the room, and the width of roll you intend to use. It then uses these figures to produce the roll estimate. Although the routine uses feet as its unit of measurement, you can always use the other options to convert the figures to another unit.



While it is unlikely that you would be carting your micro round to your local hardware merchant (ironmongers) – unless you have an Osborne (how about that for stunning the khaki-overalled sage behind the counter!) – at least you can now have all your measurements converted to umpteen different units before entering his lair again and being caught with your pantaloons adrift. The only thing you now have to worry about is if he retorts with, "Ah, but do you want the Euro-tiny, the EEC-medium or the GATT-gigantique bubble pack?"

PROGRAM LISTING

```
10 REM*** MEASUREMENT CONVERTER ***
20 REM*** BOB CHAPPELL  21/6/82 ***
30 GOTO840
40 PRINT"C    R MEASUREMENT CONVERTER ":PRINT:PRINT
50 PRINT"  DO YOU WANT:- ":PRINT:PRINT
60 PRINT"     1. U.K. STANDARD TO METRIC":PRINT
70 PRINT"     2. METRIC TO U.K. STANDARD":PRINT
80 PRINT"     3. WALLPAPER ESTIMATOR":PRINT
90 PRINT"     4. STOP THE PROGRAM":PRINT:PRINT:PRINT:GOSUB1060
100 IFN=1GOTO160
110 IFN=2GOTO250
120 IFN=3GOTO600
130 IFN=4THENPRINT:PRINT:END
140 GOTO40
150 REM*** UK STANDARD TO METRIC ***
160 PRINT"CR  UK STANDARD    TO  METRIC          ":PRINT
170 CV=0:K=0:FORJ=1TO36STEP2:K=K+1:IFK<10THENPRINT" ";
180 PRINTK;" ";D$(J);
190 PRINTTAB(17);"TO  ";D$(J+1):NEXT
200 PRINT:PRINT"R 99  RETURN  TO  MAIN  MENU      "
210 GOSUB1060:Z=INT(N):IFZ=99GOTO40
220 IFZ<1ORZ>18GOTO160
230 GOTO330
240 REM*** METRIC TO UK STANDARD ***
250 PRINT"CR     METRIC          TO  UK STANDARD  ":PRINT
260 CV=1:K=0:FORJ=1TO36STEP2:K=K+1:IFK<10THENPRINT" ";
270 PRINTK;" ";D$(J+1);
280 PRINTTAB(21);"TO  ";D$(J):NEXT
290 PRINT:PRINT"R 99  RETURN  TO  MAIN  MENU      "
300 GOSUB1060:Z=INT(N):IFZ=99GOTO40
310 IFZ<1ORZ>18GOTO250
320 REM*** CONVERT ***
330 IFCV=0THENF$=D$(Z*2-1):T$=D$(Z*2):F=CF(Z*2-1)
340 IFCV=1THENF$=D$(Z*2):T$=D$(Z*2-1):F=CF(Z*2)
350 IFZ=18GOTO530
360 PRINT"R":PRINT:PRINT:PRINT:PRINT"HOW MANY ";F$;:GOSUB1070
370 A=N*F:PRINT:PRINT:PRINT
380 REM*** ROUND THE RESULT ***
390 IFA<.01THENX=A:GOTO430
400 R=3:X=INT(A*10↑R+.5)/10↑R
410 IFX=0THENR=R+1:GOTO400
420 IFX<1ANDX>.99THENX=1
430 PRINTTAB(10);N;F$:PRINT:PRINTTAB(9);"=";X;T$;"."
440 FORJ=1TO6:PRINT:NEXT
450 PRINT"R PRESS SPACE FOR MORE ";F$;" "
460 PRINT:PRINT"R PRESS M TO RETURN TO MENU "
470 GETA$:IFA$=""GOTO470
480 IFA$=" "GOTO350
490 IFA$="M"ANDCV=0GOTO160
500 IFA$="M"ANDCV=1GOTO250
510 GOTO470
520 REM*** DEGREES ***
530 IFCV=0THENF$="DEGREES (FAHR)":T$="DEGREES (CENT)"
540 IFCV=1THENF$="DEGREES (CENT)":T$="DEGREES (FAHR)"
550 PRINT"C":PRINT:PRINT:PRINT:PRINT"HOW MANY ";F$;:GOSUB1070
560 IFCV=0THENA=5/9*(N-32)
570 IFCV=1THENA=9*N/5+32
580 PRINT:PRINT:PRINT:GOTO390
590 REM*** WALLPAPER ESTIMATOR ***
600 PRINT"C    R WALLPAPER ESTIMATOR "
610 PRINT:PRINT"ON THE BASIS THAT 1 ROLL IS 32 FT LONG,"
620 PRINT"WHAT IS THE HEIGHT OF THE ROOM,FROM"
630 PRINT"THE TOP OF THE SKIRTING TO THE CEILING,"
640 INPUT"IN FEET ";H$
650 H=VAL(H$):IFH<=0GOTO600
660 PRINT:PRINT"INCLUDING ANY DOORS AND WINDOWS (TO
670 PRINT"ALLOW FOR ANY WASTAGE CAUSED BY PATTERN"
680 PRINT"MATCHING),WHAT IS THE DISTANCE AROUND"
690 INPUT"THE ROOM,IN FEET ";D$
700 D=VAL(D$):IFD<=0GOTO660
710 PRINT:PRINT"IN FEET,WHAT IS THE WIDTH OF THE ROLL"
720 INPUT"OF WALLPAPER ";P$
730 P=VAL(P$):IFP<=0GOTO710
740 PRINT:PRINT:PRINT"THE NUMBER OF ROLLS NEEDED IS";
750 RL=(D/P)/(32/H):IFINT(RL)<>RLTHENRL=INT(RL)+1
760 PRINTRL:PRINT:PRINT
770 PRINT"    R PRESS SPACE FOR MORE ESTIMATES ":PRINT
780 PRINT"      R PRESS M TO RETURN TO MENU "
790 GETA$:IFA$=""GOTO790
800 IFA$=" "GOTO600
810 IFA$="M"GOTO40
820 GOTO790
830 REM*** INITIALISE ***
840 DIMD$(36),CF(36)
850 FORJ=1TO36:READD$(J),CF(J):NEXT
860 GOTO40
870 DATA INCHES,25.4,MILLIMETRES,0.03937
880 DATA INCHES,2.54,CENTIMETRES,0.3937
890 DATA FEET,0.3048,METRES,3.281
900 DATA YARDS,0.9144,METRES,1.094
910 DATA MILES,1.609,KILOMETRES,0.6214
920 DATA SQ INCHES,645.2,SQ MILLIMETRES,0.00155
930 DATA SQ INCHES,6.452,SQ CENTIMETRES,0.155
940 DATA SQ FEET,0.0929,SQ METRES,10.76
950 DATA SQ YARDS,0.8361,SQ METRES,1.196
960 DATA SQ MILES,2.59,SQ KILOMETRES,0.3861
970 DATA CU INCHES,16.39,CU CENTIMETRES,0.06102
980 DATA CU FEET,0.02832,CU METRES,35.31
990 DATA CU YARDS,0.7646,CU METRES,1.308
1000 DATA OUNCES,28.35,GRAMMES,0.03527
1010 DATA POUNDS,0.4536,KILOGRAMMES,2.205
1020 DATA PINTS,0.5682,LITRES,1.76
1030 DATA GALLONS,4.546,LITRES,0.22
1040 DATA FAHRENHEIT,0,CENTIGRADE,0
1050 REM*** GET SELECTION ***
1060 PRINT:PRINT"WHICH NUMBER DO YOU WANT ";
1070 INPUTN$:N=VAL(N$):RETURN
```

Major Variables

D$( ) Measurement description array
CF( ) Conversion factor arrray

The above are grouped in pairs so that they cross-refer to each other. For example, D$(1) = "INCHES", D$(2) = "MILLIMETRES", CF(1) contains the conversion factor of inches to millimetres and CF(2) contains the conversion factor for millimetres to inches.

N	No. of main option selected initially, then a work field.
CV	If 0, then UK to metric; if 1, then metric to UK conversion
Z	Sub-option selected
F$	Description of unit being converted (From)
T$	Description of unit being converted (To)
F	Factor being used in the conversion – obtained from CF( )

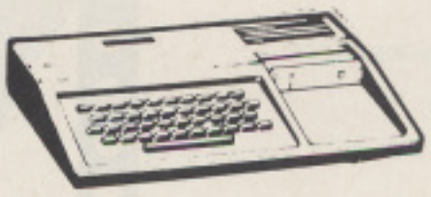
No conversion factors are obtained for centigrade/fahrenheit/centigrade from the CF array (these elements are set to zero) as the conversion is carried out in a different way from the rest.

Major Routines

40-140	Main menu
150-230	Menu for UK to metric
240-310	Menu for metric to UK
320-370	Obtains input and converts
380-420	Rounds the result to 3 decimal places unless more are required in a very low value result e.g. 0.0004 If result between 0.99 and 1.00 then result rounded as 1.
430-510	Displays result and invites further input or a return to menu.
520-580	Handles fahrenheit and centigrade conversion.
590-740	Obtains input for wallpaper estimates
750-760	Calculates rolls and displays result
770-820	Invites further input or return to menu
830-1040	Data needed for arrays
1050-1080	Input routine

Program occupies under 4k. Special symbols are the Clear Screen symbols in lines 40, 160, 250, 360, 550 and 600, and reverse R (Reverse on) in lines 40, 160, 200, 250, 290, 450, 460, 600, 770 and 780. They can safely be omitted. Line 400 contains the exponentiation symbol ↑ (upward arrow). Spelling of grammes is a deliberate attempt to curry favour with our French readers! ●

TEACH YOURSELF COMPUTING AND HAVE FUN!!



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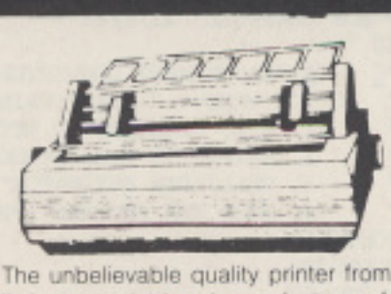

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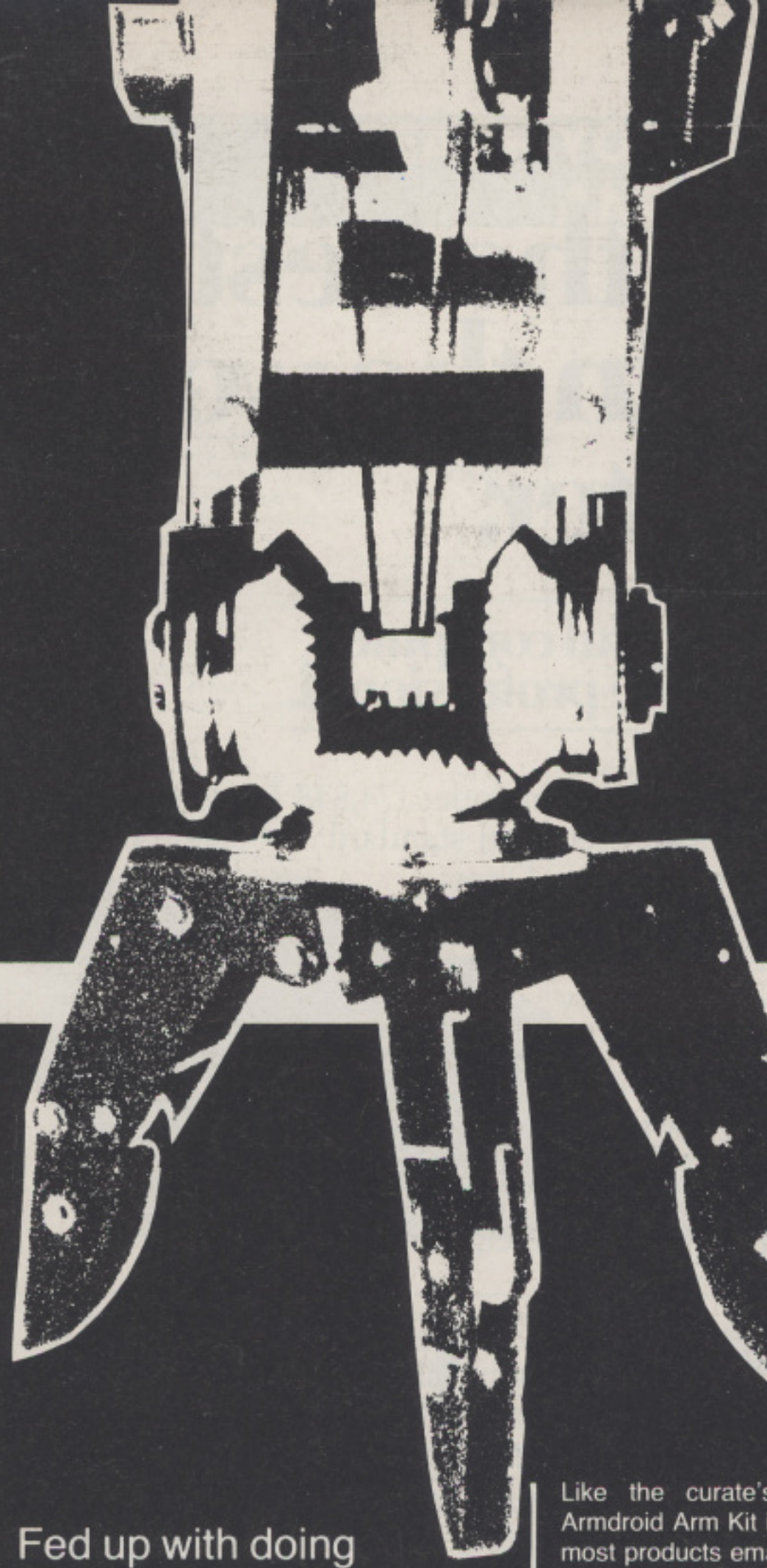


"6 Months alone with a robot"

Fed up with doing housework? Dog refusing to fetch your slippers? Need an opponent for chess or arm-wrestling? Why not build your own robot, controlled by your home computer? *MicroComputer Printout's* self-styled Darth Vader, alias **Lindsay Doyle** set about just such a project. Unfortunately, his planned takeover of the universe proved to be fraught with more practical problems – like getting the robot to work!

Like the curate's egg, Colne Robotics' Armdroid Arm Kit is very good in parts. Like most products emanating from Thatcherville these days, the instruction book is egregiously bad. But first let me tell you what the Armdroid is, before I sink my teeth into its defects. Colne doesn't believe in saturation advertising, so if you have been aware of their existence, it is because you saw the kit articles in Electronics Today International or one of the publicity release photographs which have appeared here and there in the computer press.

System parameters

Referring to the illustrations, you will see that the system consists of the arm, a separate power supply, and an optional manual control box. The base of the arm contains space for two circuit cards, one of which is mandatory and the other of which is required if you are going to drive the arm from a computer rather than just from the manual control box. As well as being able to rotate on its base, the arm has what are conveniently referred to as shoulder, elbow, and wrist motions plus a three-fingered grip. All motions are driven by stepping motors. For various reasonable reasons, not every motion has the total freedom that the uninitiated might expect. Rotation on the base does not have slip-rings to carry signals through to the arm, so freedom of rotation is limited by the degree (or should I say degrees) to which you are willing to allow the control cables feeding the rest of the system to twist and untwist. However, if the arm is placed on a flat surface it can reach anywhere in a hemisphere of 400mm radius, and it is also capable of reaching below its own base, as the camera has caught it doing in one of the photos. Table 1 indicates the parameters involved.

Other than the base rotation motor, which is mounted within the base, all stepping motors are mounted in the "biceps" area, so to speak, and motion is passed first by non-slip toothed belts for the initial gear ratio change in each case and then by nylon cables passing over pulleys. This results in the much-to-be-desired "parallelogram" type of action, in which the orientation of any section of the arm is not changed by the motion of any other joint. (Wrist motion is an exception for some reason.) For example, if the forearm is level initially, it will remain so while the shoulder joint is exercised.

As a disadvantage, this approach does mean that cables have to be threaded through a complex set of pulleys and each has to be provided with a takeup spring to absorb any stretch. As such a spring and its connections cannot pass over a pulley, this sets a limitation to the angular motion of each element.

More often the limiting factor is physical contact between one piece of the arm and

another, but in the case of the wrist twist for instance, continuous rotation is not possible, as it usually is on industrial robots to allow screwdriving and the like without ratcheting as we poor humans must do.

Mechanical

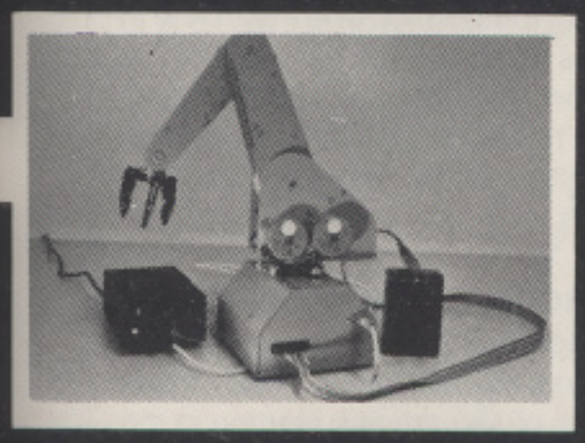
At this point I would like to state my unqualified admiration for the quality of the components supplied. With very few exceptions the gears, bushings, sheet metal fittings, etc. are fabricated to best industrial standards and no shortcuts or scrimping are evident in this department. However, the quality of the picking and packing was another matter altogether. Whole subsets of parts were missing from my kit, and conversations at my expense in which I was told that I must be mistaken, did not help my incipient ulcers.

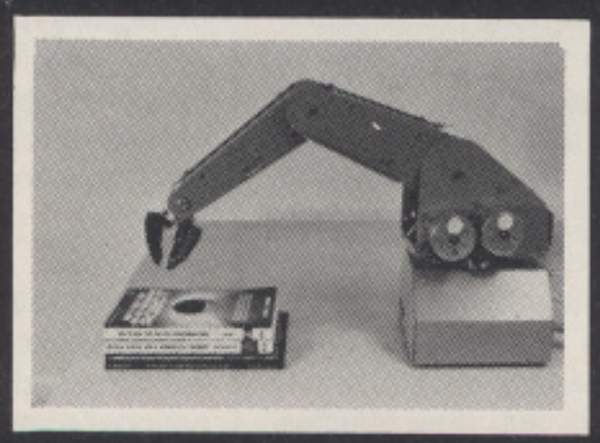
Many parts, as one might expect, are similar but required in paired left and right versions. Try explaining that you have received two "lefts" when the only way to tell the difference is whether the countersunk hole is on the same side as the flange when you hold the piece with the narrow end up.

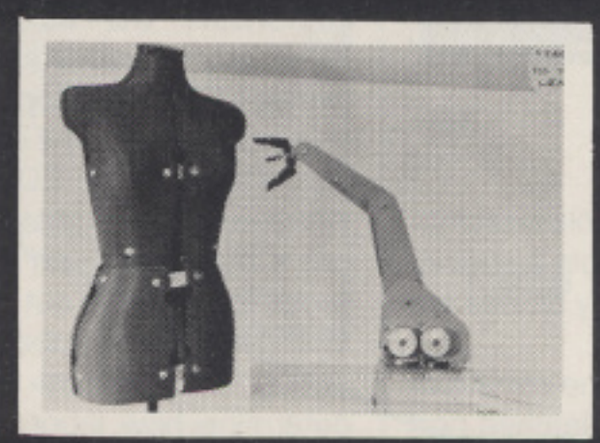
Little or no attention has been paid to the design of the shipping carton, with the result that the heavy power supply crashes about, bending the corners and scratching the paint off various other fitments. The power supply itself, supplied as an assembled unit, although I had ordered a kit, is an oddity, purchased, I suspect, at a fire sale or from the remnants of a cargo freighter sunk on the way from Taiwan to Birmingham. One of the two I ended up with worked initially. Both had cases fabricated of dead-soft aluminium, so thin that it could be bent with finger pressure. The chassis were bent and the control panels were dented and hand-painted (with brush streaks) in black, no doubt to disguise their origin. Fuseholders were cracked and the power switches mounted upside-down.

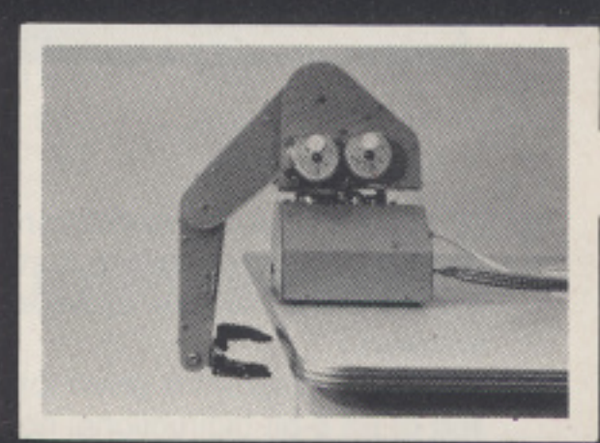
The manual control box, also ordered as a kit, came assembled and wired, and was of good quality, but I suspect that most users will prefer to make a simple modification to the circuit which I shall discuss later. Other missing components included a set of reed switches and magnets to operate them, and the excuse for not including these was that they are now priced as a separate optional kit. When I did eventually receive them I found that a number of spacers required to mount them were not included either in the original set of parts or in the kit.

Some amongst you may be asking yourselves why it took me so many telephone calls to find all these errors. Why didn't I lay out all the parts and identify and count them against the quantities on the parts list? Well, friends, the parts list doesn't give quantities! Also there are assembly drawings in which the parts numbers are in some cases omitted and in other cases different from the numbers in the parts list. Entirely different and unrelated parts have been issued identical numbers. The illustrations of some parts are unidentifiable, some are shown in place backwards, and some are shown in the wrong position. In short, the assembly instructions are a blivet, the definition of which, for those not familiar with it, is not suitable for inclusion in a family magazine. You will have to be, or consult with, a mechanical genius to complete the physical assembly of the arm. Fortunately, I fit this category in addition to my other skills, or I would have thrown the whole thing in the dustbin many months ago. Two very nice miniature spanners and three Allen keys are included with the kit, but you will also require a small quantity of Vaseline or heavy grease, light lubricating oil, and, not least, a pair of the smallest size of Circlip pliers. These last are really essential, as I can vouch, having tried all kinds of homemade alternatives before I went out and bought my own set.









Electrical

The quality control on picking and packing for the printed circuit components was on a somewhat higher level, though again I had to phone for some missing parts, and some connectors listed and illustrated in the handbook have still not been supplied. Assembly should pose no problems for anyone skilled in the art, although the heat sinks provided don't fit. Whoever wrote the circuit description of portions of the handbook did not appear to understand the circuit, or else major changes were made after the book went to press.

Ignoring the handbook, what is actually provided is the option of three modes of operation. In the Manual Mode, all components of the Driver Board are required, and if use of this mode only is contemplated, the Interface Board is not required. There is no provision in this mode for utilizing the magnetic reed switch option (more about this option later). An on-board clock to generate the pulses necessary to drive the stepping motors is included on the Driver Board, and operation is fully parallel, i.e. all motions may be commanded simultaneously if you can find the fingers to do it with on the manual control box. Operation may be switched between this mode and Computer Mode I but not Computer Mode II. (See below).

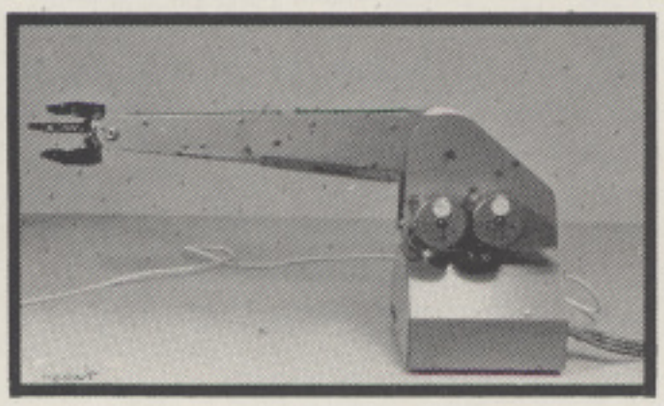
In Computer Mode I all components of both boards are utilized. The computer is called on to generate clock and direction pulses and a three-line address to select one out of six motors. Latches on the Interface board make operation fully parallel. The four-phase motor drive square waves are generated on the Driver Board from the computer clock and direction pulses. The reed switches can be connected to read back to the computer.

In Computer Mode II, all components of the Interface Board are used, but only IC4 and IC5 of the Driver Board. The computer must generate the complete four-phase motor drive square wave set as well as a three-line address. The sensing switches read back to the computer. In this mode, there is no provision for switching to external manual controls: it is intended that the computer keyboard be used for this purpose.

Moving on to the question of the now-optional reed switches: what are they for, and how well do they work? They are intended to provide a reference starting position for each motion, a necessity for computer-driven operation unless you are willing to set the arm manually to a standard start position each time before energizing it. They are very difficult to install and adjust, their resolution is low, and their repeatibility is poor. This is the nature of the beast, considering that the operating magnet may approach the reed switch from either of two directions and its flux may be affected by adjacent magnets, by vibration from the machine, and by axial slop (the polite word is 'tolerance') of the gear on which it is mounted. The proper technique for this function is optical (midget photocell sees light through tiny slot when alignment is correct), and no doubt a capable experimenter could design his own optical rig, but I would not recommend buying the reed switch set for this purpose. Can they be used as limit switches instead? No, because you would need two switches for each motion, and the other considerations would still apply.

I must give a separate paragraph to discussion of the wrist motions and the control thereof, and I shall choose to put it here at the end of the electrical section since the criticism I have to offer is in the electron department. Inspection of the photographs will confirm that there is a differential gear set in the wrist. This is driven by two independent motors. When both are rotating in the same direction, the wrist bends so as to adjust the axis of the hand with respect to the horizon (remember that the parallelogram mechanics ensure that the hand axis is independent of the forearm axis). When the two motors rotate in opposite directions, there is no bending motion but instead the wrist is caused to rotate or twist about the hand axis. As supplied, the manual control box is wired so that one of two lever switches (three-position, spring return to centre, but it sometimes sticks) controls each wrist motor. One can easily imagine the complexities involved in trying to operate the two switches simultaneously while remembering that A up and B down gives twist clockwise (or is it B up and A down, or is it both up together???...) Any electronics buff could tell you that there is an easy way to wire the ▶

"6 Months alone with a robot"



◀ switches so that one switch controls twist motion and the other switch controls bending. (Hint to Colne: two teensy weensy diodes are required.)

A circuit diagram is given for the construction of an 8-bit bidirectional non-latched port for the TRS-80 bus. This circuit is not included on the circuit boards supplied. The PET's parallel output port should be quite compatible without any added circuitry.

Software

As of my latest information, the only program offered is one for the TRS-80 Model I level II and tape, an annotated listing of which is included in the handbook. This program suffers from a number of deficiencies, some of a technical nature, others of a structural nature, and, far from least, others having to do with bad documentation. Whoever wrote the comments apparently was taught that one should never refer to a function by the same name twice. Like streets of Dublin, a different name is applied every block or two. As to the matter of punctuation, its absence makes it impossible to determine the intended sense of many instances. What are we to make, for example, of the following?

```
;Clear
;byte in MOTBF user wants both
;directions clear byte
```

As there are no flow charts supplied, and as the poor comments make it exceedingly difficult to follow the intended sequence of functions, you will have to take my word for it that I have laboriously prepared my own set of flow charts for every routine and subroutine of the TRS-80 program in preparation for designing my own program to be compatible with PET. I can therefore report to you that a sequence of moves is recorded as an array of one-byte signed binary numbers, six motors wide by any length desired. In the spirit of not using the same name twice, one set of six bytes is variously referred to as a 'row', a 'slice', and I forget what all else. I shall attempt to be consistent and call it a 'row'. Each number in a row, as it varies from −128 through 0 to +127, corresponds to typically about + or −30 degrees of arm movement, although this varies from one motor to another for valid reasons.

The concept of teaching movements to the system which has been implemented is the naive one that the arm is expected to faithfully reproduce the exact timing and sequence of the manual commands fed to it during the teaching process. As there are six motors to control, each having three conditions (off, forward, and reverse), the user might simultaneously press up to six out of a set of twelve keys on the keyboard of his computer. If any one of the six motions carries the stored count beyond + or −127, the count for all six at that moment becomes poured in concrete, a part of the record for everymore.

Three undesirable results ensue. First, it is not possible to build up complex motions by entering simple motions one at a time and expecting to have them combined on playback. Second, any manual errors, hesitations, or overshoots will be faithfully reproduced. Third, any motion requiring the right subset of twelve keys to be depressed simultaneously is too complex for the ordinary human to carry out. There is an EDIT mode provided, in which one can observe a numerical display of one's masterwork on the screen and can attempt to smooth it out or combine motions by changing the numbers and moving them about. I leave it to the reader's imagination to determine how laborious and how effective such a process will be.

In my opinion a different approach altogether is called for. I feel that the teaching process should consist of defining a set of points in space through which the arm must pass and between which the computer should determine the optimum path. These points need only be the positions where motion is to be stopped or changed in direction. The job of the teacher should be to define these points: the job of the robot should be to find the best path between such points, and it should be of no concern to the robot whether the teacher's path was jerky or non-optimum or had to be subsequently corrected or was made up of a series of single-motor motions.

Is such a philosophy more difficult to implement than the do-as-I-do philosophy of the original program? No! In fact it is easier, as well as easier to understand. Will it require more storage? No, in fact it will use considerably less. Why, then, did Colne Robotics not implement it? Gross inexperience and gross stupidity can be discounted. For some reason these are not acceptable excuses in this day and age. Perhaps they were misled by poorly-chosen consultants? (This is a very popular excuse, ranking close behind "typographical error", "computer error", "incompetent vendors", and "strikes in Outer Mongolia" in today's Hit Parade.)

What to do? You can write your own program if you are competent in the machine language of your particular micro, but BASIC will not do, as it is much too slow. For myself, I am in the process of writing one in FORTH, dropping into Assembly for the speediest bits of the inner loops, and would be pleased to tell you about it in detail, but the Editor has a THING against FORTH and will not allow any mention of it in these sacred pages. If you were all to phone him up and complain, all three of you, perhaps he would change his mind.

Instruction book

The ten-page "introduction" is a soporific essay about the role of the robot in industry, which includes the statement that the development of Colne's small robotic arm was "largely accidental". I leave you to draw your own conclusions. Did I mention proofreading? "Capter on software", "monthly newlsetter", "subscibe", and "possiblitily" are typical examples, all taken from page 1-2. On another page, though we find "possiblilty" and "possiblity", just to show that the writer, typist, proofreader (?), etc. are not hung up on a monotony kick.

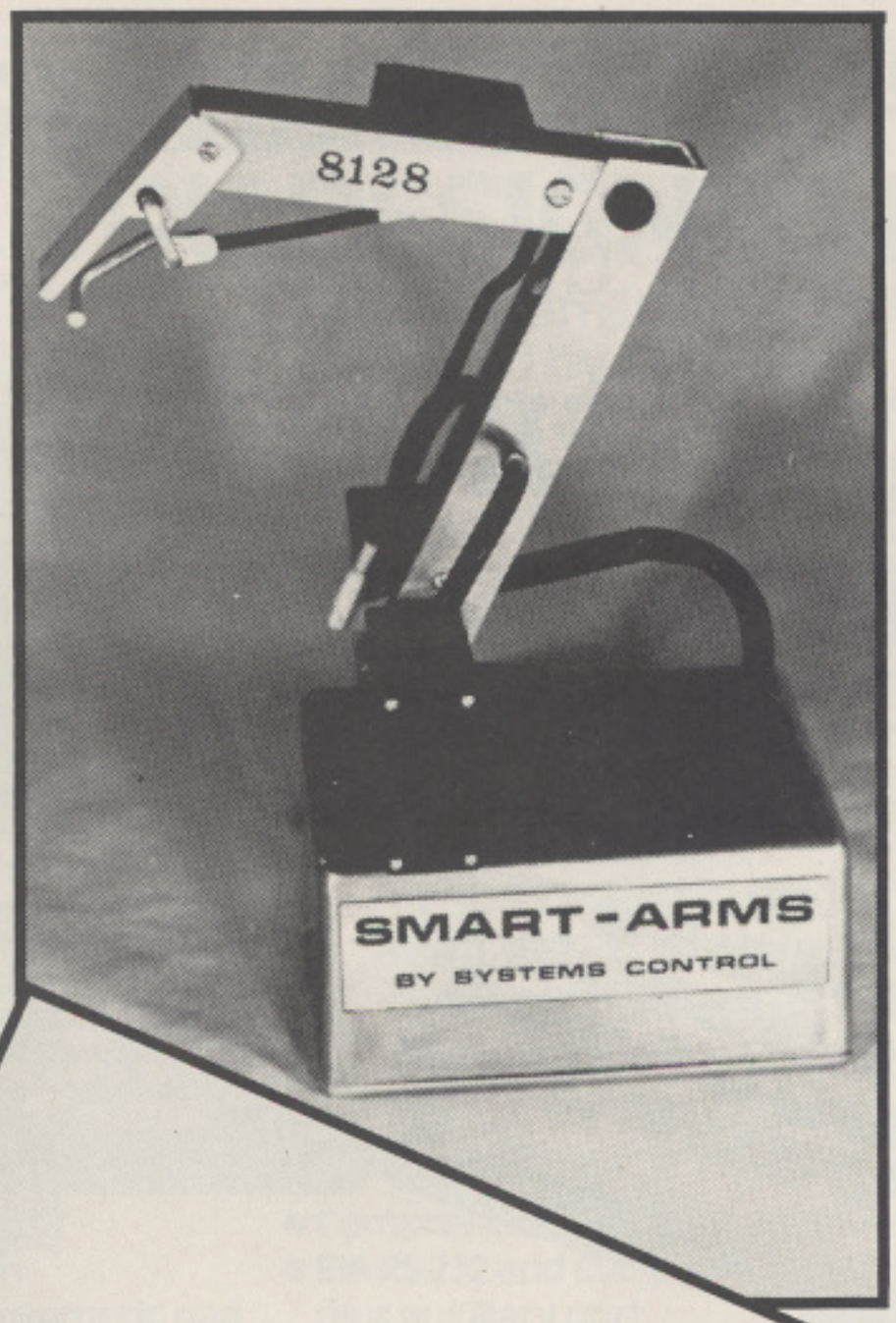
Incidentally, there has been no sign of any "newlsetter" in the first eleven months. Other favourites are "menue", "subroutes", "hyperdermic", "dealy", and "A frined will be useful but it is quite possible without". (I tested this statement and found it to be correct.) There is the usual scattering of pages out of order and references to non-existent tables and appendices, the type of thing which one might find in a schoolchild's first rushed attempt at a laboratory report. The chapter called "Applications" doesn't discuss applications but explains how to change the program for half-stepping.

Delivery and correspondence

To my knowledge, the first announcement of the Armdroid was in Electronics Today International's series of two articles starting in the September '81 issue. I ordered my kit on 11 August '81, received the Users Handbook on 16 October with a written promise of despatch of the kit within the week, received the incomplete kit in dribbles over a period starting on 17 February '82, and have not received certain inter-board connectors as of this moment, which is 21 July '82. When, several weeks after the originally-promised delivery date had passed, I phoned to enquire when I might expect delivery, a brassy young woman informed me that my "crane" had been shipped "yesterday". This turned out to be a terminological inexactitude of the first water, as no actual shipment was to take place for over 90 days. Again, having studied the handbook and wanting to prepare for I/O to my PET while I waited for the kit, I wrote to the managing director, politely stating my interpretation of the circuit diagrams and how they differed from the test and asking if he would have his staff confirm my assumptions. I never received an answer to this or a second copy of the same letter or a telephone call in which his secretary acknowledged receipt of the letters. Even phoning for a set of current catalogue literature (so as to be sure to include the latest information in this article) resulted in a promise but no response. I don't think that they have gone out of business, though, as I see that a hopeful agent is advertising the product in the American magazine, Byte, and even promises an improved handbook "soon" as well as programs for PET and other micros.

Conclusions

Truly this is not a "shake-the-box-and-it-will-assemble-itself kit." Anyone tackling it would be well advised to have spent his formative years wisely in learning both electronic and mechanical skills and to be prepared to deal

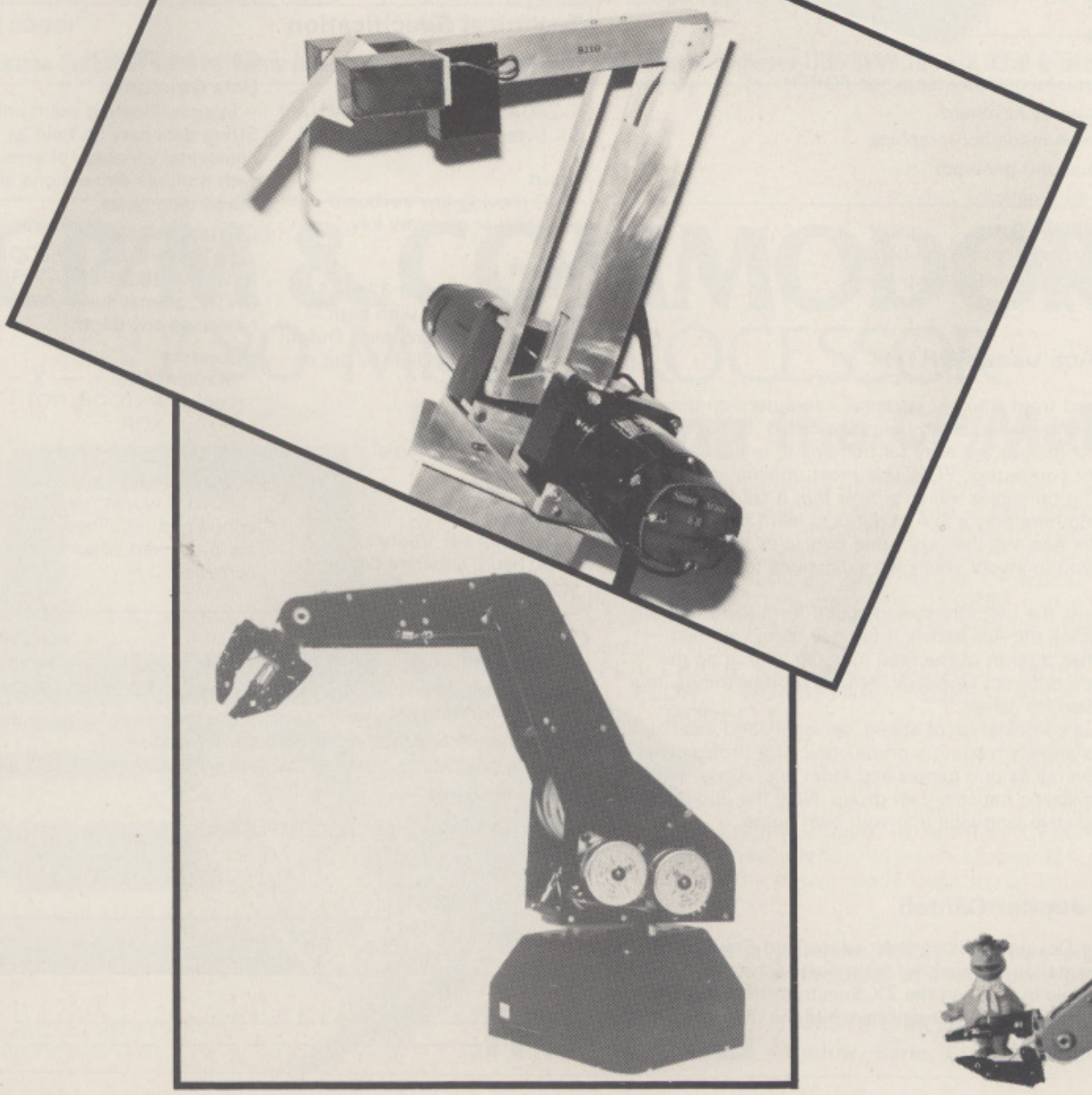


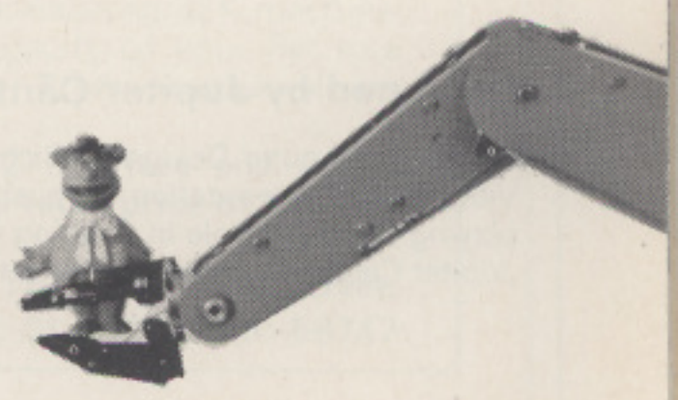
Robot arms suitable for interfacing to a microcomputer are growing increasingly popular amongst schools and home experimenters. Colne are by no means the only supplier. Shown here are a ready-assembled version of the Armdroid, and two similar mini-robots (called Smart Arms) supplied by Systems Control of Northallerton in North Yorkshire.

with the types of vendor response that I encountered. I would not hold my breath waiting for improved documentation or programs or expect any technical assistance from the manufacturer. On the other hand, Colne does offer assembled units if you feel you are ready to tackle the program design aspect. If you persevere, you will end up with a practical robot arm, capable of grasping and lifting objects such as chess pieces and the like, of up to almost a pound in weight, and positioning them with reasonable accuracy and repeatibility under manual or computer control. Although not suited to industrial applications, it is ideal as a demonstrator in the classroom or hobbyist's home, and I can report that it is the best window display in town for bringing shoppers in for a closer look and 101 questions.

Motion	No. Of Steps	No. Of Degrees	Notes
base	(several	revs.)	1556 steps per rev.
shoulder	1222	198	
elbow	1204	195	
wrist	864	200	
grip	763	50	per finger

Table 1: Motion Parameters





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Software, FORTH

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AGGRESSION!

Master simulation writer, **Humphrey Walwyn**, has developed a program which models world politics. No, it isn't a game – the computer does everything. But just watching the screen can be an educating experience, and the program documentation gives a very good insight into writing your own simulations.

Computers are logical beasts – humans are not. Machines are predictable and rational objects – humans are liable to do anything they feel like doing. It's just as well that there are no hard and fast rules governing human behaviour. The world would be a much less interesting place if everyone conformed to a set of automated instructions. There would be no emotions, no inventions, no artistic flair, no individuality – an ocean of grey predictability and all-embracing boredom.

I suppose there might be some advantages in a totally structured society. All human fallibilities would be erased. There'd be no point in fighting wars because the outcome would be a mathematical certainty – no greed since everyone would be equally poor or rich – no lies since the whole truth would always be available.

In real life, the truth rests somewhere between the two extremes of mechanical rationality and human individuality. There *are* sets of guidelines that a majority of people will follow even if they are only instinctive reactions to given circumstances. If Person 'X' is richer than Person 'Y', then Person 'Y' may get envious. If this continues for a length of time, then Person 'Y' may let increased envy turn into aggression. If the amount of aggression increases for Person 'Y', then Person 'X' will feel threatened and both will let their respective aggression tendencies increase until the kettle boils over.

Here's a very simple example of such a progression in program terms where the variable 'R' is the amount of money, 'E' is the 'Envy factor' and 'A' is the 'Aggression factor'.

```
10 LET R(X)=RND(1)*10:LET R(Y)=RND(1)*10
20 IF R(X)>R(Y) THEN E(Y)=E(Y)+1
30 IF E(Y)>A(Y) THEN A(Y)=A(Y)+1
40 IF A(Y)>A(X) THEN A(X)=A(X)+1
50 IF A(Y)+A(X)<20 GOTO 20
60 PRINT"X AND Y HIT EACH OTHER ON THE
NOSE"
```

Of course, that is extremely simple since it only contains one side of the picture. Person 'Y' would have to be programmed to react in the same way as Person 'X' and – to stop an automatic progression to conflict – you would have to include some lines which decelerate the aggression factor. Either person could have an upper limit to their 'Envy factor' – a point at which they cease to be envious because they are temporarily satisfied with what they've got. The different variables must also interconnect with each other. For example, you could perfectly well make a case for saying that the higher the 'Aggression factor', the less the contentment and peace of mind, and therefore the lower the amount of money earned.

The possibilities are quite endless and you can spend many hours of trial and error computing a series of equations until you think you've solved the problems of the world. You haven't, of course. But it can produce some very interesting results.

What I've done is to take a mythical world where eight

AGGRESSION! LISTING BREAKDOWN

Lines	Explanation
10-110	Array dimensions and DATA standardisation
120-170	Randomised initial set-up
200-295	Display and main logical chain with "check system"
500-999	Main DATA alterations (see below for specific lines)
1000-1040	'Military take-over' subroutine
1100-1160	'Internal revolution' subroutine
1400-1420	'Army increase if enough money' sub-routine.
2000-2060	Border screen print for display
2065-2099	Country 'box display' subroutine
2100	Clear top line subroutine
2240-2460	Individual country 'box display' routine
3000-3010	Initiate screen print positions for 'x' and 'y'.
4000-4010	'Get any key' screen display subroutine.
5000-5800	Country's relationships with both neigh-bours and display
5802-5886	'Countries at war with each other' sub-routine
5900-5999	Check system for 'end of war' subroutine
7000-7040	'One country victorious' and end of game routine.
7500-7540	'World peace and disarmament' and end of game routine.

countries (numbered in the program from 0-7) are ranged around a central lake. Each country has two neighbours and a host of internal problems to contend with. To keep it as simple as possible, there are only five sets of variables for each country (numbered from 0-4 in the program). Each variable has only five possible values – again numbered from 0-4. These are represented in the program by A$(4,4) and C(7,4).

AGGRESSION! LISTING OF MAIN VARIABLES

XY(7,1)	The screen display print positions for a 40 column VDU where the first part of the array applies to the country (0-7) and the second part to the 'X' and 'Y' co-ordinates. Hence XY(2,1) is the screen start print position for the third country in the vertical co-ordinate.
A$(4,4)	The adjective used in the screen display to show the state of each country. The first part of the array refers to the type of DATA being displayed... 0=Political type, 1=Military strength, 2=Governmental strength, 3=Financial state of the country and 4=the country's foreign policy. The second part of the array is the degree (also 0-4) of each of the above. This ranges from far Left to far Right in the political spectrum and has different values for the other types of DATA.
C(7,4)	The current state of each of the above types of DATA currently existing in each country where the first part of the array (0-7) is the country and the second part (0-4) is the DATA type.
C$(7)	The name of each country from 0-7.
R$(4,1)	Adjectives or print statements used in the 'relationships' phase where the second part of the array (0-1) applies to the two lines of print required. Like the other DATA statements – A$(4,4) – there are five degrees of relationship. 0='Very friendly' and so on up to 4 which is the worst state of inter-country relationships that can exist – 'At War'.
R(7)	The current state of the above inter-country relationship as defined by the friendliness – or more likely lack of friendliness – between the country and its nearest neighbour in an anti-clockwise direction.
Q(7)	The country that 'owns' the subject country. Normally, since a country 'owns' itself, this will have the same value as the subject variable e.g. Q(4) will equal 4 and Q(7) equal 7 etc. However, sometimes countries get conquered in various wars that might develop and then the 'Q' matrix will return the subscript number of the new ruling country.
N$(7)	The 'news lines' from 0-7. These are the main print lines and are constantly changed with new DATA as the program progresses.

NOTES ON PROGRAMMING

The program was written for any type of 40-column PET but can easily be converted to run on other machines.

The program fits within 8K if all the REM statements are removed. Some of the lines are really only included to make the general screen appearance more attractive. Dispense with them as you see fit!

The variables used are fairly complex. To go deeply into the mechanics of the 'flip-flop' variable theory where individual matrices interact with each other would probably confuse everyone more than necessary. Suffice it to say that it *does* work. Some of the program lines may need extra explanation as the 'meat' of the calculations are centered around lines 500 to 999.

Lines

535	If the country does not hold extreme political views and has a stable or strong democratic government, then the country's riches will increase. The variable Q1 in line 535 is the level of world wide affluence. This is set at a value of 1 but can be altered upwards (richer) or downwards (poorer) as required. See line 17.
560-570	If the country has a weak government, then it tends to drift towards greater democracy. There's nothing very unusual about this ... power is gradually devolved to the people until there is either an internal revolution or outside events (threatening neighbours) increase the stability.
640	The more democratic a country becomes, the less beligerent it becomes.
650	Beligerency will increase with mutual distrust. If a neighbouring country holds radically different political views then threantening noises are expressed!.
660 & 665	If a neighbour has a stronger army than the country in question, then there will be an automatic re-armament programme ... providing it can pay for it.
670 & 675	The converse of the above lines ... if a neighbour has a smaller army and is less aggressive, then there is a need for increased friendliness and soothing talk.
680 & 685	These lines are perhaps the most cynical ... military spending will automatically follow the country's foreign policy. The harder a country becomes, the more it sees itself as threatened and so will build up its armies regardless of its neighbours.
690 & 695	The 'law of greed' ... any country surrounded by more affluent neighbours will feel envious and therefore take a more aggressive stance in foreign affairs!
698	The poorer a country becomes, the more internal unrest there is. This is not a hard and fast rule – what is in a program like this? – but, together with the other program lines, this line prevents the world becoming happy AND poor. Not realistic!

AGGRESSION!

The DATA for these variables is given in lines 50 - 71. The names of the countries in lines 80 and 82 are entirely fictitious so can be altered to suit your own desires.

All you do is type RUN and off it all goes! Just keep pressing any key to show the changing DATA for each country and the relationships between each neighbour. Sometimes internal revolutions will take place, wars will break out and alliances will be set up. This is not a game. There is no competitive involvement by a number of players. It is – if you like – a limited working model of a world and its problems. It's a test tube of peace and aggression. Using the current equations, I find that world peace and disarmament occurs after about twenty years. This might be construed as naive simplicity and – to be fair – it obviously is! However, every now and then, a super power will emerge and attempt to rule the world. Indeed, there are only two possible

```
READY.

READY.

 10 DIM Q(7),R(7),R$(4,1),C$(7),A$(4,4),C(7,4),N$(7),XY(7,1)
 12 REM R:RELATION SHIP TO NEIGHTBOUR -1
 14 REM R$:RELATIONSHIP STRING IN2 LINES
 15 REM N$(7):1-7 NEWS LINES: A$:0=STATE,1=ARMY,2=STRENGTH,3=$,4=POLICY
 17 Q1=1
 19 FORI=0TO7:FORJ=0TO1:READ XY(I,J):NEXTJ,I
 20 FORI=0TO4:FORJ=0TO4
 25 READA$(I,J):NEXTJ,I
 30 FORI=0TO7:Q(I)=I:READC$(I):NEXTI
 35 DATA 1,3,14,3,27,3,27,11,27,19,14,19,1,19,1,11
 50 DATA "COMMUNIST   ","SOCIALIST   ","LIBERAL     ","CONSERVATIVE"
 51 DATA "FASCIST     "
 55 DATA "  NO ARMY  "," WEAK ARMY ","ARMY IS OK "," GOOD ARMY "
 56 DATA "V.GOOD ARMY"
 60 DATA "VERY WEAK   ","WEAK        ","STABLE      ","STRONG      "
 61 DATA "VERY STRONG "
 65 DATA "$=VERY POOR.","$=POOR.     ","$=AVERAGE.  ","$=RICH.     "
 66 DATA "$=VERY RICH."
 70 DATA "PEACE LOVING","FRIENDLY    ","NEUTRAL     ","AGGRESSIVE  "
 71 DATA "BELLIGERENT "
 80 DATA "  ATLANTIS  ","  BOHEMIA   "," CARMANDIA  "," DELPHINIUM "
 82 DATA " ELEPHANTIA ","  FREEZIA   ","  GREEDIS   ","  HORRORIA  "
 83 FORJ=0TO4:FORI=0TO1:READR$(J,I):NEXTI,J
 85 DATA "  ARE VERY  ","  FRIENDLY. "," ARE ALLIES."," "
 86 DATA " ARGUE WITH "," EACH OTHER."," ARE OPENLY ","  HOSTILE.  "
 87 DATA "   ARE AT   ","   W A R    "
100 Y$="■■■
```

outcomes to this program – either Global peace or Global domination.

Lines 120-170 are simply involved in randomising the initial set up. It might be more interesting to structure the initial scenario yourself and then run the program several times to see if it always comes out the same way. It won't.

I don't think there are very many lessons to learn from the results. Indeed, if anyone is presumptuous enough to think that the real world and its problems can be solved on a microcomputer, then they're deluding themselves. If only life was so simple!

But then, if it was, there would be no point in running this program because you'd know the result before you started. As it stands, you don't.

```
2320 B$=A$(3,C(K,3)):GOTO2350
2330 B$=A$(1,C(K,1)):GOTO2350
2350 IFQ(K)=KTHEN2420
2360 IFS=2THENB$="  IS NOW A  "
2370 IFS=3THENB$="  PART  OF  "
2380 IFS=4THENB$="■"+C$(Q(K))
2420 IFS=7THENPRINTLEFT$(Y$,Y+S-1);LEFT$(X$,X);B$;"■":GOTO2460
2440 PRINTLEFT$(Y$,Y+S-1);LEFT$(X$,X);B$
2460 NEXTS:RETURN
3000 REM START POSITIONS
3010 X=XY(K,0):Y=XY(K,1):RETURN
4000 GOSUB2100:PRINT"■ PRESS ANY KEY TO CONTINUE    ■YEAR"YN
4005 GETA$:IFA$=""THEN4005
4007 PRINT"■                                ■YEAR"YN
4010 RETURN
5000 REM RELATIONSHIPS
5010 V=K-1:IFV=-1THENV=7
5012 IFQ(V)<>VTHENV=V-1:IFV=-1THENV=7
5014 IFQ(V)<>VTHEN5012
5015 IFC(V,4)=4ORC(K,4)=4ANDRND(1)>.7THENZ=4:GOTO5030
5020 Z=INT((((C(K,4)+C(V,4))*.85)+(ABS(C(V,0)-C(K,0)))+(C(V,1)+C(K,1))/6)*.4)
5030 IFZ>4THENZ=4:IFC(K,1)=0ANDC(V,1)=0THENZ=3
5040 IFZ<0THENZ=0
5100 AP=AP+Z-2
5500 IFYN=1ANDZ>3THENZ=3
5600 GOSUB2065
5610 N$(1)="■"+C$(V):N$(2)="■    AND    ■":N$(3)="■"+C$(K)
5620 N$(4)="■"+R$(Z,0):N$(5)="■"+R$(Z,1)
5621 IFYN=1THEN5630
5622 IFZ=4THENGOSUB2070:N$(5)=B1$:GOSUB2070:N$(5)="■"+R$(4,1):GOTO5630
5627 IFZ<R(K)THENN$(7)="■(IMPROVING) "
5628 IFZ=R(K)THENN$(7)="■  (STATIC)  "
5629 IFZ>R(K)THENN$(7)="■(WORSENING) "
5630 GOSUB2070:GOSUB4000
5700 R(K)=Z
5750 IFZ>0THENAP=1
5800 IFZ<4THENRETURN
5802 IFC(K,1)>0ORC(V,1)>0THEN5810
5805 N$(6)="■BUT THERE IS":N$(7)="■NO FIGHTING":GOSUB2070:GOSUB4000:RETURN
5810 V5=C(V,1)*((C(V,2)+1)/3):K5=C(K,1)*((C(K,2)+1)/3)
5825 IFV5=0ANDK5=0THEN5805
5830 IFV5=0THEN5850
5832 IFK5=0THEN5860
5834 IFV5>K5*1.5THEN5870
5836 IFK5>V5*1.5THEN5880
5840 REM STILL FIGHTING
5842 C(K,1)=C(K,1)-1:C(K,3)=C(K,3)-1
5844 C(V,1)=C(V,1)-1:C(V,3)=C(V,3)-1
5846 N$(6)="■% ARE STILL ■":N$(7)="■FIGHTING...■":GOTO5900
5850 REM K VICTORY
5851 C(K,3)=C(K,3)+C(V,3):IFC(K,3)>4THENC(K,3)=4
5852 N$(6)="■"+C$(V):N$(7)="■ SURRENDERS ■":GOSUB2070:GOSUB4000
5854 FORL=0TO7
5855 IFQ(L)<>VTHEN5858
5856 Q(L)=K:FORI=0TO4:C(L,I)=C(K,I):NEXTI
5857 U=K:K=L:GOSUB3000:GOSUB2240:K=U
5858 NEXTL:GOSUB3000:RETURN
5860 REM V VICTORY
5861 C(V,3)=C(V,3)+C(K,3):IFC(V,3)>4THENC(V,3)=4
5862 N$(6)="■"+C$(K):N$(7)="■ SURRENDERS ■":GOSUB2070:GOSUB4000
5864 FORL=0TO7
5865 IFQ(L)<>KTHEN5868
5866 Q(L)=V:FORI=0TO4:C(L,I)=C(V,I):NEXTI
5867 U=K:K=L:GOSUB3000:GOSUB2240:K=U
5868 NEXTL:GOSUB3000:RETURN
5870 REM V WINNING
5872 C(K,1)=C(K,1)-1:C(K,3)=C(K,3)-1
5874 C(V,3)=C(V,3)-1:C(V,2)=C(V,2)+1:IFC(V,2)>4THENC(V,2)=4
5876 N$(6)="■"+C$(V):N$(7)="■ IS WINNING■":GOTO5900
5880 REM K WINNING
5882 C(V,1)=C(V,1)-1:C(V,3)=C(V,3)-1
5884 C(K,3)=C(K,3)-1:C(K,2)=C(K,2)+1:IFC(K,2)>4THENC(K,2)=4
5886 N$(6)="■"+C$(K):N$(7)="■ IS WINNING■":GOTO5900
5900 GOSUB2070:GOSUB4000
5910 FORI=0TO4:IFC(K,I)<0THENC(K,I)=0
5920 IFC(V,I)<0THENC(V,I)=0
5930 NEXTI
5935 FORR=0TO7:IFQ(R)=VTHEN5940
5937 GOTO5970
5940 FORI=0TO4:C(R,I)=C(V,I):NEXTI:K=R:GOSUB3000:GOSUB2240:K=P
5970 NEXTR
5999 RETURN
7000 GOSUB2065:N$(1)="■"+C$(Q(0)):N$(2)="■ RULES THE  ■":N$(3)="■   WORLD
7005 N$(4)="▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"
7010 N$(6)="■END OF GAME "
7015 GOSUB2070
7020 GOSUB2100:PRINT"■ PRESS ANY KEY TO START AGAIN ■YEAR"YN
7030 GETA$:IFA$=""THEN7030
7040 RUN
7500 GOSUB2065:N$(1)="■WORLD PEACE ":N$(3)="■DISARMAMENT ■"
7505 N$(4)="▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒":N$(2)=N$(4)
7510 N$(6)="■END OF GAME "
7515 GOSUB2070
7520 GOSUB2100:PRINT"■ PRESS ANY KEY TO START AGAIN ■YEAR"YN
7530 GETA$:IFA$=""THEN7530
7540 RUN
READY.
```

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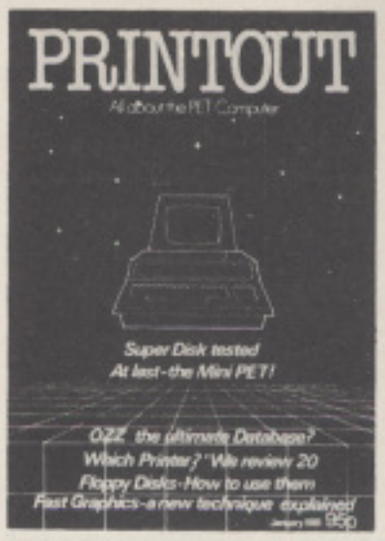

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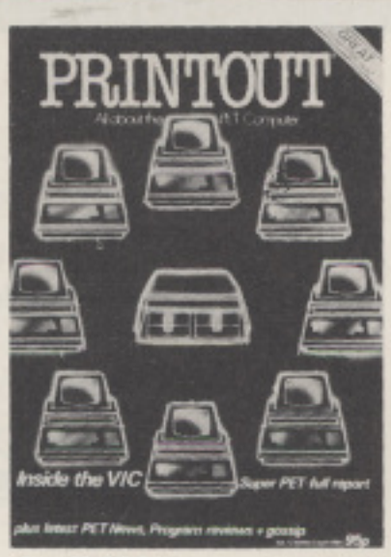

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Buying a micro?!

'How to choose your dealer' last month has provoked reaction from both trade and customers. The following is one reader's light-hearted view of his local dealer.

(CUE: Sensible man entering 'Honest John's Fast Micro Takeway')

Customer: "Ah, good morning. I'd like to buy a micro computer please."

Salesman: "Yes certainly sir: for personal or business use, may I enquire?

Customer: "Oh, personal I think. I don't really know enough to make a living out of these little electronic beasties."

Salesman: "Don't let a little lack of knowledge stop you, sir: we certainly don't."

Customer: "I'm sorry?"

Salesman: "Nothing sir, just a bit of polite conversation to put you at your ease. Right, now we have an extensive selection of all the most modern models: do you have any particular model in mind?"

Customer: "Errr...., no, not really."

Salesman: "Oh good, good, I find an open mind does so help in choosing these machines." (Evil grin spreads across his face as he contemplates his naive victim with predatory glee.)

Customer: "Well, I suppose I'd quite like it to be small, and if it could match the hi-fi system that would be a plus."

Salesman: "Very wise, sir, I'll see what I can do....oh yes, here we are: the Cybernaut Z-79½....very popular model, sir."

Customer: "Does it have a full ASCII standard?"

Salesman: "Come again, John?"

Customer: "Is the keyboard full ASCII standard?"

Salesman: "Best quality plastic pushbutton, sir – don't you worry about that – none of your cheap stuff."

Customer: "Is it a CP/M operating system?"

Salesman: "The operating system ?????"

Customer: "Yes, the operating system – what is it?"

Salesman: "Well, you have to press the buttons – see these things here at the front with letters written on them – look, like this. Tell you what, I'll turn it on for you, shall I?"

Customer: "How unusual! The prompt appears to be small green space monster."

Salesman: "Err...yes! American standard, sir."

Customer: "Really! But not CP/M though, is it?"

Salesman: "Well, not as such, guv, no, not yer actual CP/M, but very nearly though."

Customer: "What is its basic RAM capacity?"

Salesman: "Well it's not really designed for keeping sheep in."

Customer: "Its memory capacity, dolt!"

Salesman: "Look, sunshine, this job can remember lots of bloody things, lots."

Customer: "A figure? 16K, 24K, 48K?"

Salesman: "Yeah!"

Customer: "Which one?!"

Salesman: "All of them!"

Customer: "What do you mean 'all of them'?"

Salesman: "Versatile eh, cock – lovely colour case eh? Good green plastic, none of your cheap chrome here, eh?"

Customer: "How about colour graphics?"

Salesman: "Oh yeah, the instruction book is in colour alright."

Customer: "Floppy disks available?"
Salesman: "No way, 'course not mate: no cheap stuff, all ours are solid. Got a lot of keys hasn't it, eh pal, nice colour aren't they?"
Customer: "What is its baud rate to cassette?"
Salesman: "...good the way the letters are in black, makes them easier to see eh, eh shall I pack it for you now?"
Customer: "The baud rate, please, sonny?"
Salesman: "Lovely little on-off button at the back..."
Customer: "What's the bloody baud rate?"
Salesman: "A lot."
Customer: "How many?"
Salesman: "Err.... two!"
Customer: "TWO! *TWO!* Is that all?"
Salesman: "Oh baud rate, I thought you said 'bored', oh baud rate, oh well, that can be as much as, oh say, fifteen?"
Customer: "Have you any other machines here?"
Salesman: "Yeah John, got lots: you don't want the cybernaut then?"
Customer: "No, thank you..."
Salesman: "I'll throw in a free 'Star Trek in 7 dimensions' game and a set of plastic stick-on ears..."
Customer: "No thanks!"
Salesman: "Right then. How about the 'K-9 Look Alike'?"
Customer: "No, thank you, Brian."
Salesman: "The 'Mutangibinni Corporation Wangdiddler – 6' with Space Crusher 3 cassette?"
Customer: "Not really."
Salesman: "The 'Ooopidoom-MFI Self-assembly Balsa-wood model 5', with seven free cassettes, including 'Thing Zapper' and 'Extra-Terrestial Disembowler'?"
Customer: "No. Now look kid, have you got any real computers here, say any of the Sinclair machines?"
Salesman: "Err...no! Not much call for them here, sunbeam."
Customer: "But it's the most popular model in the world"
Salesman: "We find the buttons drop off, so we don't stock them."
Customer: "The PET?"
Salesman: "Sorry, no livestock, this is a computer shop after all."
Customer: "So you keep claiming! Superbrain?"
Salesman: "Kind of you to say so, sir. How about the 'Milton Keynes 9' with 'Bug-Eyed-It Groin Kicker 2'?"
Customer: "How about the TRS-80? The 'Apple'?"
Salesman: "Out of date now sir, but if you wanted a good game of 'Alien Throttler', the Newport-Pagnell battery powered ZX-8e is unbelievable..."
Customer: "How long have you been selling micro computers?"
Salesman: "Very experienced staff we have here sir."
Customer: "How long?"
Salesman: "Three weeks, and that's a long time in this business: I've been on a course..."
Customer: "How long did that last?"
Salesman: "Errr....twenty five minutes actually: we learned how to load 'Space Invaders' cassettes."
Customer: "Good morning."
Salesman: "Want to buy a toaster?"

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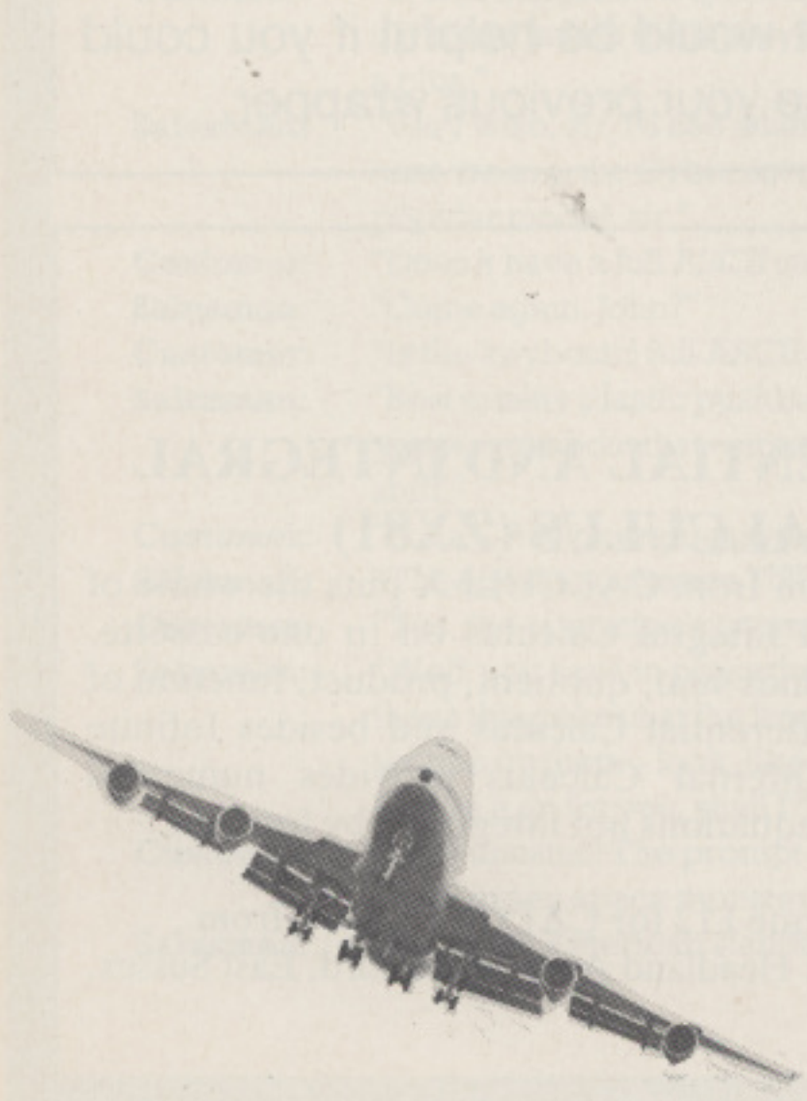
TRAVEL AGENTS

Communications – the ability to obtain up-to-date minute and accurate information about airline reservations – is one of the main requirements of computers for travel agents. But as **Martin Hayman** discovered, while some travel companies are developing massive Prestel-based systems, other entrepreneurs are going for low-key desktop micros.



It is remarkable that the airline industry is losing £578m a year. Travel, as everyone knows, broadens the mind; freedom of movement is an enfranchisement; it is one of the first freedoms to go in a totalitarianism. One would think that people in the West had enough of the folding stuff to buy all the free movement on offer from the world's airlines; but apparently not.

The airlines' loss-making is blamed almost entirely on a problem of its own making: discounting. Airlines are not permitted, by the international rules of air travel, to sell their seats at less than a fixed price agreement by the cartel of major airlines. Yet apparently there is more capacity than travellers are asking for. Those demons, market forces, come into play and the airlines are compelled, with a little arm-twisting by travel agents, to knock-out short-dated flights at reduced prices.

What has this to do with computing, you may ask. The answer is that it is a situation ripe for exploitation with a little ingenuity and a microcomputer. Look at it this way: a respectable airline has a flight to a destination, say Sydney. It sells some seats at £n for a while, then as the date of departure approaches, it cuts the price to £0.6n. After a certain cut-off period, it stops selling tickets direct to the public and knocks out the residue to some lucky travel agents on exclusive arrangements. The travel agents are then free to re-package those flights as they will – or even, indeed to sell them on. Surely a market niche for a little entrepreneurial microcomputing?

Computing is not new to the travel trade; airlines have been using mainframes and distributed processing for many years, of course, to do their own reservations, invoicing and ticket issuing. Such applications demand high-speed real-time processing – all points of a system must have the same, constantly updated information all the time; no use selling a seat in London at mid-day and the same seat in Abu Dhabi five minutes later.

Communications, then, are paramount in the running of airlines – but the scope of the travel agent, who has already pre-bought his block of tickets and so does not have the same real-time needs, is much narrower. He may need to interface with the airlines' own reservation computers; but he has a far greater need to keep his own house in order with conventional data processing applications such as can be performed on a table top micro – the usual old things like accounts, mailing, billing and so forth.

For the most part, systems which have been sold to the travel trade as "new technology" involve links with some kind of mainframe capability – whether that takes the form of the airlines' own reservations computers, or viewdata systems. Potentially, viewdata has a great deal to offer the travel trade – it is a simple and robust system which is reasonably easy to use for specific applications (rather than for generalised information).

But it has snags when it is used as a mixed system – that is, in conjunction with other kinds of computer. Prestel is best used as a stand-alone system in its current stage of development, because it has a unique operating system demanding unusual protocol conversions when used in conjunction with conventional data-processing computers. It also has a 40-column screen, which makes for headaches when displaying files of information set out for industry-standard 80-column computers.

Prestel has gone a long way towards eliding these problems for the user with its Gateway service, and conversion of protocols is always possible – at a price. IBM, for example, has found viewdata a sufficiently interesting application to build a front end for their System/1 mini which will convert conventional files into viewdata 40x24 format.

Just to remind ourselves of the potential use of viewdata – which does not necesarily mean Prestel, which is merely British Telecom's own implementation of it – it has cheapness, reliability, is easily legible (an 80-column screen requires a lot of concentration when used soley as an output device for information) and it runs on the telephone system aided by a cheap modem (which could well be an acoustic coupler). Editing is straightforward and a good-sized database can be built up on most modest mini-computers. This means that data can be swiftly updated and distributed – just what travel agents need to tell them whether a particular flight is available.

This is the road down which Prestel, seeing a copper-bottomed market, has aimed at full tilt. The result was Skyguide, which was opened this May with all the usual IT 82 crew in attendance to break a bottle of champagne over the bow. The way it works is this: flight arrival and departure information provided by air traffic controllers and airlines to the airports authority, for display on the airports' own flight arrival and departure boards, is monitored by a micro-based device built by Jasmin Electronics of Leicester from Mullard chips.

This flight data, which might be in any of a variety of formats depending on which system is in operation at the airport, is fed via a specially adapted version of Jasmin's viewdata editing terminal to the American Express computer (a Rediffusion R800/70) on British Telecom's Switchstream packet switched service. Jasmin say that the microprocessor control system is so programmed that it can receive information in any one of a number of formats. The operating system is modular – input, storage and output are independent to allow of maximum flexibility in

application. "This is particularly useful," says Jasmin, "in dealing with diverse airports using a wide range of flight information systems based on displays ranging from 32 to 80 characters a line."

It can be seen, then, that one of the biggest headaches in communications between airline and hopeful holidaymaker – sitting in the High Street travel agent's wishing he had thought to book his holiday earlier – is the business of the format in which data is held. This has had a major effect on the strategy adopted by would-be computer applications designs in the travel trade and, naturally, on the cost of those applications.

One of the earliest of the communications systems for the travel trade, and probably the best known, is Travicom, which was the first system to allow access to several different computers from one terminal. In effect it was a terminal which would emulate any of the systems to which you might wish to direct it. Its original purpose was for reservations only, then an accounts package was added to make it more attractive.

The agent who used Travicom was likely to have a large turnover because at £7000 a year, it was extremely expensive. Furthermore, in order to preserve the pecking order, it was available only to IATA members, not to the trade as a whole. There was plenty of scope for resentment and room for change.

It is here that viewdata systems offer a lot. Obviously it is going to be expensive to build, own or rent a terminal which has to interface with a variety of different computers with differently formatted files. But with a viewdata system, someone else owns all the gear that does all the protocol and formatting transactions. What you get, as a retail agent and his customer in a front-office booking situation, is a predictable, colourful screen which is easily legible and up-to-date.

All the installed hardware you need is a Prestel set which can be rented cheaply as a business expense – or bought. You might even opt for an adaptor and a standard TV set; the point is that all the tricky business which requires computing power is being done inside somebody else's computers. Hence, with the Skyguide idea, conversion of data format is done automatically at source, and the host computer updated regularly. You need not know that you are going through the Gateway when you key 2691 to get the American Express database – nor do you want to.

Prestel is on to a Good Thing here – one of the most successful areas for Prestel is the travel trade with about 2800 registrations. This seems to argue that the system is good for particular applications rather than for the generalised reference database which British Telecom predicted five or so years ago and which has so far yielded only 16,000 registrations. Relaxation of the rules surrounding the BT monopoly on attachment of equipment to BT lines enacted in last year's Telecoms Bill, coupled with the recent announcement of the Government's intention, in its (presumed) next term of office, to put Telecom on a more commercial footing, has attracted a variety of small and not-so-small microprocessor firms to cast their eyes enviously at the profit potential of private viewdata systems.

Some smaller microcomputer firms with viewdata expertise such as Technalogics and Hi-Tech have shown interest, but viewdata's use of a 40x24 screen format has caused some design difficulties except on computers using the S-100 motherboard. It is notable that Acorn Computers have yet to market the viewdata interface for the so-called BBC Micro – even though committees meet at the highest level to try and harmonize the protocols with those of teletext (broadcast screen text) in which the BBC and commercial TV chain obviously have a much greater interest. But both Rediffusion and Philips are exploring the private viewdata market enthusiastically.

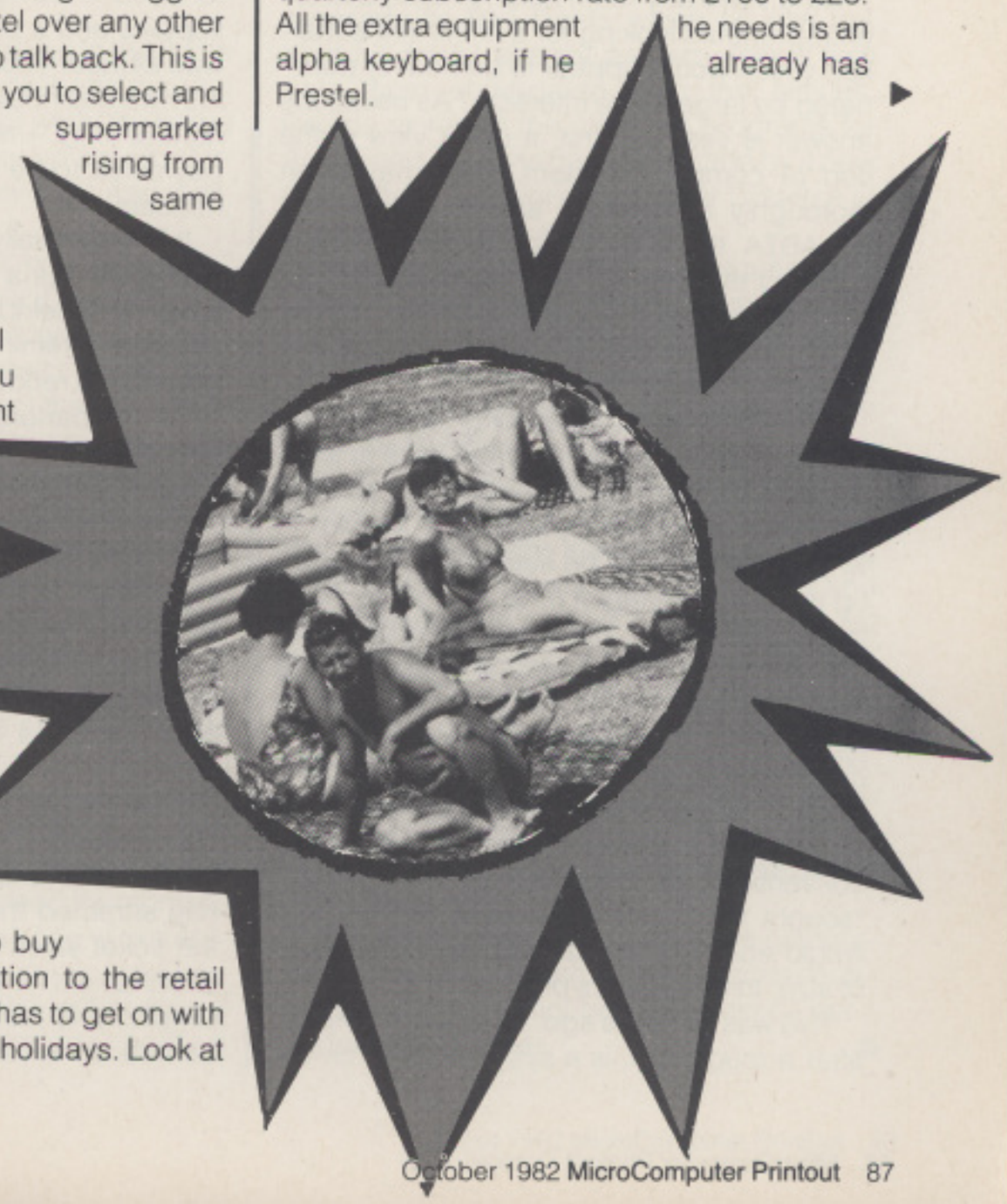
Prestel, however, is not letting the grass grow under its feet and has extended the concept of Skyguide with its new Skytrack system due to go operational in November. This is what the travel agents have been waiting for – the ability to book direct from Prestel on to airlines' own computers.

This is important. The single biggest claimed advantage of Prestel over any other system is that it allows you to talk back. This is what, in theory, will enable you to select and buy goods from the supermarket shelf without ever rising from your armchair. The same could be true of flights, or holidays. You go down to the travel agents, rifle through a few colourful brochures, decide what you want, and instruct the agent to dial up the flight and make the reservation, in the full confidence that when you come to take your seat, it will not have been sold to anyone else.

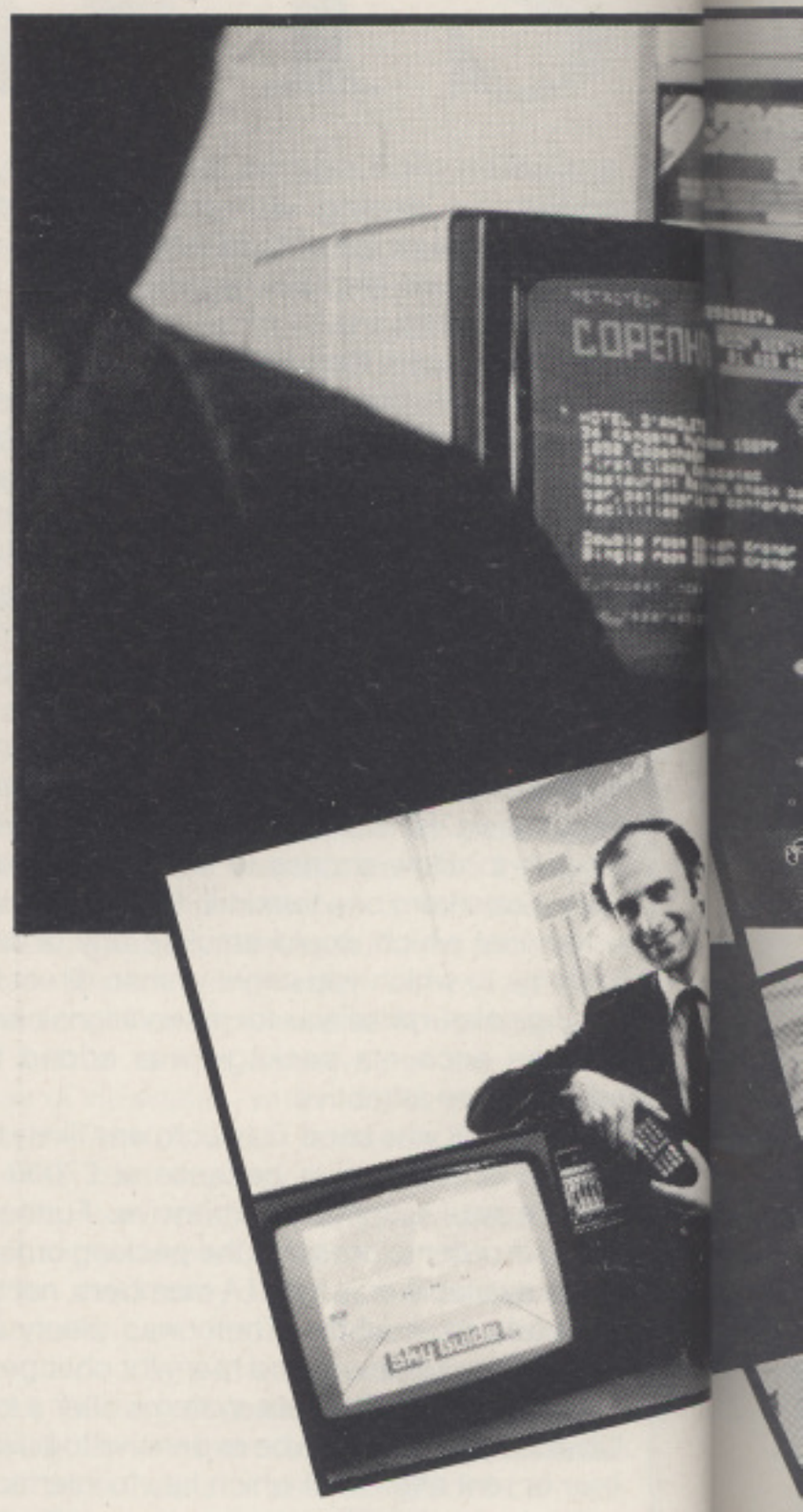
Information systems which allow you to inspect the goods and then to go on to buy them are a useful proposition to the retail trade. The individual agent has to get on with earning his living by selling holidays. Look at it this way: a real-time information system is lovely to have if you need to adjust the timings of coaches to pick up passengers from delayed flights, or for couriers wondering if they can get a bit of lunch in before the next party arrives. But to the individual – and it is at the individual level that the microcomputer technology must appeal if it is ever to be more than an administrative tool – whether he be the buyer or the seller of flights, it is vital to be able to close the deal.

This is what is claimed for Skytrack which, like Skyguide, brings a private electronics firm, Videcom, into collaboration with British Telecom in a kind of joint partnership which Sir Keith Joseph must have had in mind when drafting the Telecoms Bill. Videcom makes communications terminals specially for airport systems and have used X25 protocol and Gateway to hook up with Prestel.

The upshot of this business is that you can book your ticket from a travel agent's and the travel agent gets a very favourable deal from Prestel. He, lucky fellow, does not have to bother his head about what sort of technology he is using because somebody else takes care of that business, leaving him to concentrate on what he knows best, which is selling flights and holidays. And, compared with the other options he has of on-line systems, such as the revised Travicom and, if he is with Thompson, TOP (Thompson On-line Program), it is remarkably cheap: special introductory offer gives a discount on the flat quarterly subscription rate from £100 to £25. All the extra equipment he needs is an alpha keyboard, if he already has Prestel.



TRAVEL AGENTS



◀ One especially elegant feature of the system is the exploitation of the Prestel electronic mailbox. Messages from the airline to the agent detailing anything from changes to onward flights to missing luggage are stored by the Skytrack computer and squirted directly onto the Mailbox node on Prestel (as it happens, by-passing the X25 high-speed link used for other data) for distribution to agents' own terminals. This is splendid and, if it works, will be sure to catch on with agents. Prestel's marketing man Brian Dungate aims to equip all travel agents with Skytrack and hopes to have up to 700 travel agents and eight airlines by the time the service is launched on November 1st.

For once it seems, Prestel holds the aces and the £500-a-month Travicom systems has been forced to include Prestel capability. But what of the computing side? Although most travel agents polled by the Association of British Travel Agents cited communications as the most important side of information technology, very few, it appears, are planning to introduce new machines in the near future. A trade association recently reported that "the vast majority" of agents had no plans to install extra computer facilities or to join a "national network" before two years were out. Marketing Opinion and Research (MORI) reckons that 60% of agents said they would not install a computerised ticketing or accounting system within the year.

So is there any room here for computerate entrepreneurs looking for a chink in the market, which would appear to be heavily dominated by large-scale interests? As usual, the answer is yes. But first, a quick view of the sort of computer system which has been thoroughly researched and recommended by ABTA themselves and which certainly contains everything that a future agent, running presumably a paperless and maybe even brochureless office, could conveivably want.

Modulas is one of those long-term, design-by-committee jobs which must have in it everything that anyone might possibly ask for, now or in the future; the kind of system in which nobody must be seen to have slipped up in the specifying. It must, of course, have the Prestel facility; but it must also be capable of handling all the regular housekeeping work for which the micro is famous in all its other small- or medium-sized business applications: accounts, word processing, orders, billing, mailing. The preamble to Travel Systems Ltd.'s Modulas system alludes to the conventional wisdoms of the micro age... "sought to identify a computer system that would enable any retail agency, regardless of size, to increase its productivity."

This was six years ago. What has emerged, after a rough ride, is a system based on the Intel 8088 or 8086 processor with either 128K or 256K running under MP/M and with a variety of built-in software and the option of dual floppies or hard-disk units running from 6-80MB. A 15" high-resolution 80-column screen and 15cps daisywheel printer are standard, and there is a choice of ports, including one dedicated for Prestel. This is no hand-held calculator, and the costs, purchase or rental, are commensurate. A basic system is said to start at £6,000 and deliveries are expected soon.

In the micro business, how soon is soon? There seems to be little sense of urgency in getting the finished product out on the street, which is understandable, given the state of flux of the company's backing, and only three prototypes are currently at work.

What of the true micro, or personal computer? Yes, they are out there and are being used. But like so many of their kind, they tend to be humble, unsung, and covered with gaffer tape and coffee-cup rings. One travel agent who has come from the enthusiast side to write his own system is Nick Nichol, whose Carefree Travel of Waltham Cross, Herts, is a one-man operation and not likely to need the supposedly future-proof expandability of a system such as Modulas which aims to be all things to all travel agents.

Nichol based his system on the Tandy TRS-80 (because it was cheap) and wrote his own software (because that's what he was interested in doing). It is a Model II with twin floppies and a printer, and the installed cost was £4,500. Though devised specifically for his own business, the menu of features has a familiar ring – reminders of accounts due, payments to be made, incoming tickets reminders.

It is essentially an office aide-memoire – and prints out a daily checklist of the day's jobs. Ten weeks before the date of a flight, for example, it reminds the user to chase the tour operator to render his final account; ten days before departure, a further reminder that tickets should by now be in the office. Thus its use is a safety net.

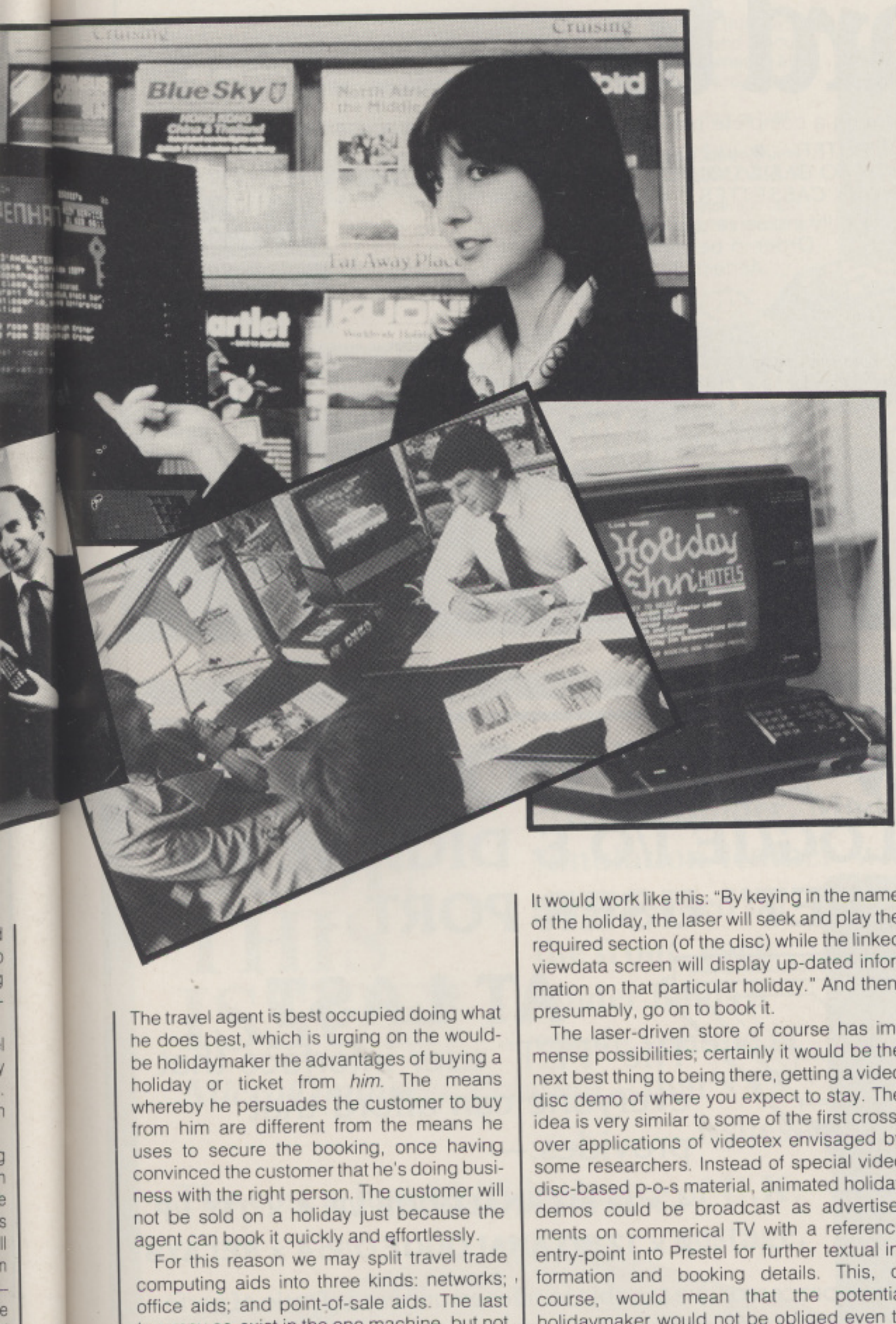
Nichol is critical of the complexity of Modulas and says that there are certain astonishing omissions – there is no such safety net in Modulas, he reckons – the user, at the time of booking, must write himself a reminder to chase up accounts and so forth, rather than having such a report automatically generated.

Though he never intended to, and does not, market his software, Nichol's simple business aid (system is too grandiose a word) has attracted the attention of 10 buyers for the ticket sales side, including the obscure Brazilian airline Labair. He is convinced that simplicity is the key – the fact that he embarked on writing the software only a year after achieving competence in BASIC and successfully implemented it with only two months' parallel operation with the existing manual system, tends to support his assertion.

What makes life complicated for travel agents who wish to go computer is that they are fixated with the idea of communications. Perhaps they have been oversold too long on the dazzling speed of airline systems.

Nichol argues – counter to the prevailing orthodoxy on "convergence" – that it is much better to separate the computing and the communications side of the travel agent's operation. Let the big boys take care of all that tricky business with protocol conversion – who needs it all lying around the office? – and go for Prestel. Then, as a tool for office accounts, ticketing and all the other banal but vital bits of office routine, go for the cheapest and most effective microcomputer system.

He's probably right. A quick overview of the travel trade's uses for computing would seem to suggest that it is still too obsessed with the technology, too little interested in the service. Much effort is being spent on integration which may not be necessary or useful.



The travel agent is best occupied doing what he does best, which is urging on the would-be holidaymaker the advantages of buying a holiday or ticket from *him*. The means whereby he persuades the customer to buy from him are different from the means he uses to secure the booking, once having convinced the customer that he's doing business with the right person. The customer will not be sold on a holiday just because the agent can book it quickly and effortlessly.

For this reason we may split travel trade computing aids into three kinds: networks; office aids; and point-of-sale aids. The last two may co-exist in the one machine, but not the first, unless the agent is prepared to spend a lot more on computer hardware. The office aid side is fairly well-documented for serious software engineers – but how about the p-o-s side? For instance, a video firm, Everard Videodisc Publications, is using a Philips Laservision disc player, linked to a microcomputer and Prestel, to give holiday demos (see 'Videodisk' in our August issue). It would work like this: "By keying in the name of the holiday, the laser will seek and play the required section (of the disc) while the linked viewdata screen will display up-dated information on that particular holiday." And then, presumably, go on to book it.

The laser-driven store of course has immense possibilities; certainly it would be the next best thing to being there, getting a video disc demo of where you expect to stay. The idea is very similar to some of the first cross-over applications of videotex envisaged by some researchers. Instead of special video disc-based p-o-s material, animated holiday demos could be broadcast as advertisements on commerical TV with a reference entry-point into Prestel for further textual information and booking details. This, of course, would mean that the potential holidaymaker would not be obliged even to make it down to the travel agent's office and would soon become in danger of losing the use of his legs.

A dovetailed viewdata/teletext system of this kind would, of course, need harmonized terminals for capture of off-air and wire-transmitted data. Any takers?

At the current stage of play, with the summer creeping on and still not holiday booked, what we are really looking for is a cheap and quick getaway. Finally, it is the selling of the service which the customer wants. And it is here that the micro may be able to make its cruelest and most cost-effective contribution to the travel agent's pocket, the tourist's itinerary, and the maximum dismay to airline managers.

If I wanted to know just what was available and wanted to test out a number of possibilities for long-distance holidays, I'd go to Anthony Pearce's Airline. Effectively all that Pearce has done is to computerise the manual search procedures which any bucket shop operator worth his salt knows inside out. The final repository of the fugitive airline tickets which the airlines need to sell and with which this article begun, is the bucket shop – the dregs of the travel trade.

It was these shoestring concerns, run out of dingy, flyblown accommodation addresses in London's West End, which finally compelled the airlines to discount their fares, giving rise to a whole new area of business. The kosher travel agents, finding there was no way of enforcing IATA's edict on price-fixing, grumbled so much that they were losing business to the backstreet merchants that they compelled the airlines to discount to them, opening the floodgates to cheap – and damaging – fares.

What Pearce – already notorious with estate agents for his ultra-cheap Homeline agency (see *MicroComputer Printout* June 1982) has done is to double up on his existing kit, several Apple II Europluses, which are already in use running matching programs of home buyers and sellers for the estate agency off a Corvus hard disk. Now he runs programs to find flights which he can get from his travel agency partner, who in turn gets them short-dated from the airlines. Pearce stores all the data and programs for Airline on a 5M-byte hard disk made by a new British firm, Symbiotic Computer Systems of Croydon – costing all of £1,400.

When the customer makes a request for a particular destination, the usual airline destination code is entered into the Apple, along with the proposed period of departure (divided into 24 half-month periods) and within seconds (between 5-15) you get a list on screen of all the flights that Airline offers, complete with details of the carrier, which days of the week that flight leaves (out and back), adult, child and infant fare, flight number and any special restrictions or conditions. The list is printed out (postal service only – no front-office, brochures or video disc displays) and sent to the customer who can, if he wishes, cite a credit card number which the computer direct debits at the credit card head office. Then Pearce goes away, makes the reservation in a conventional way by telephone – and takes his 9% mark-up.

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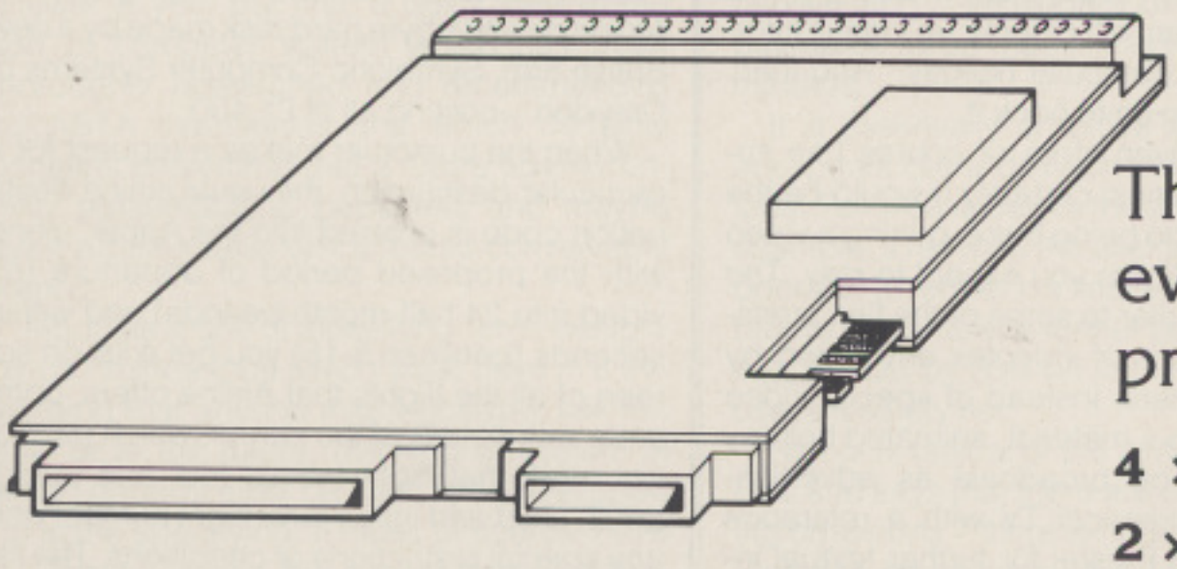

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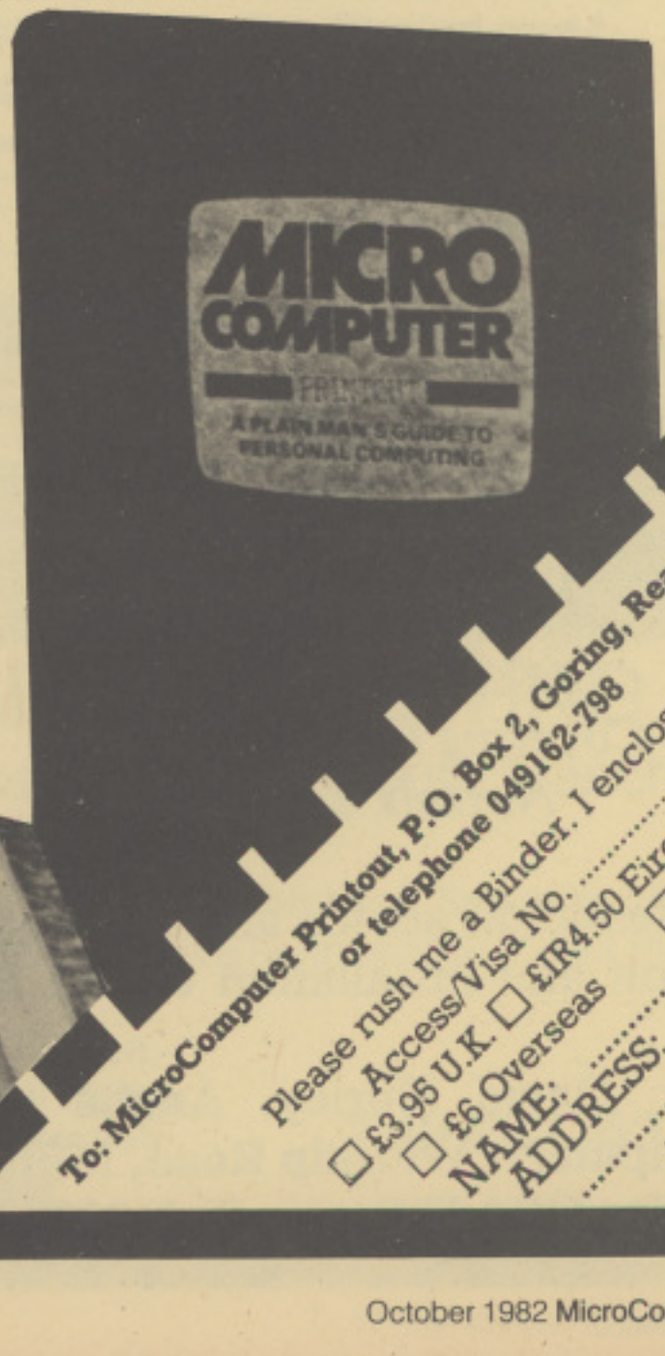

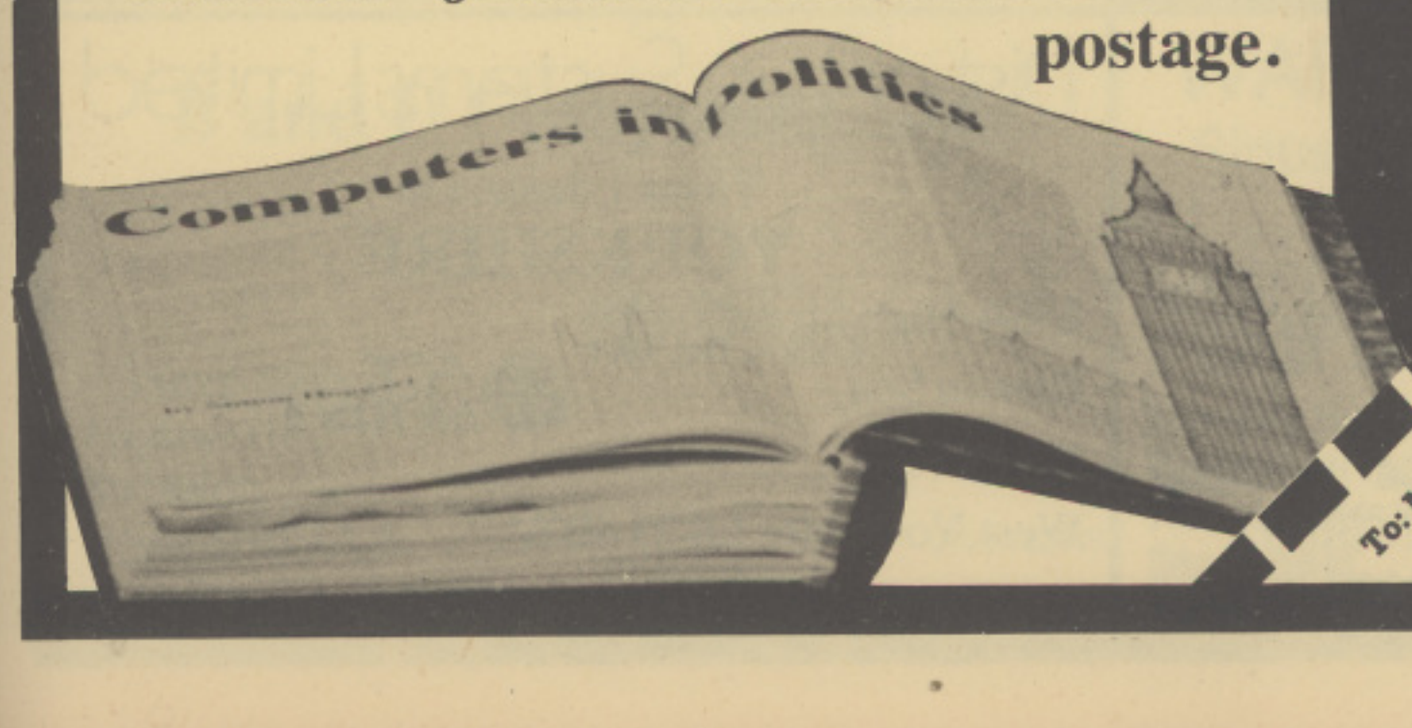

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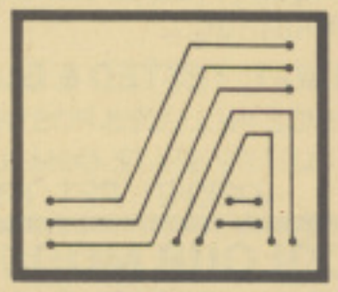

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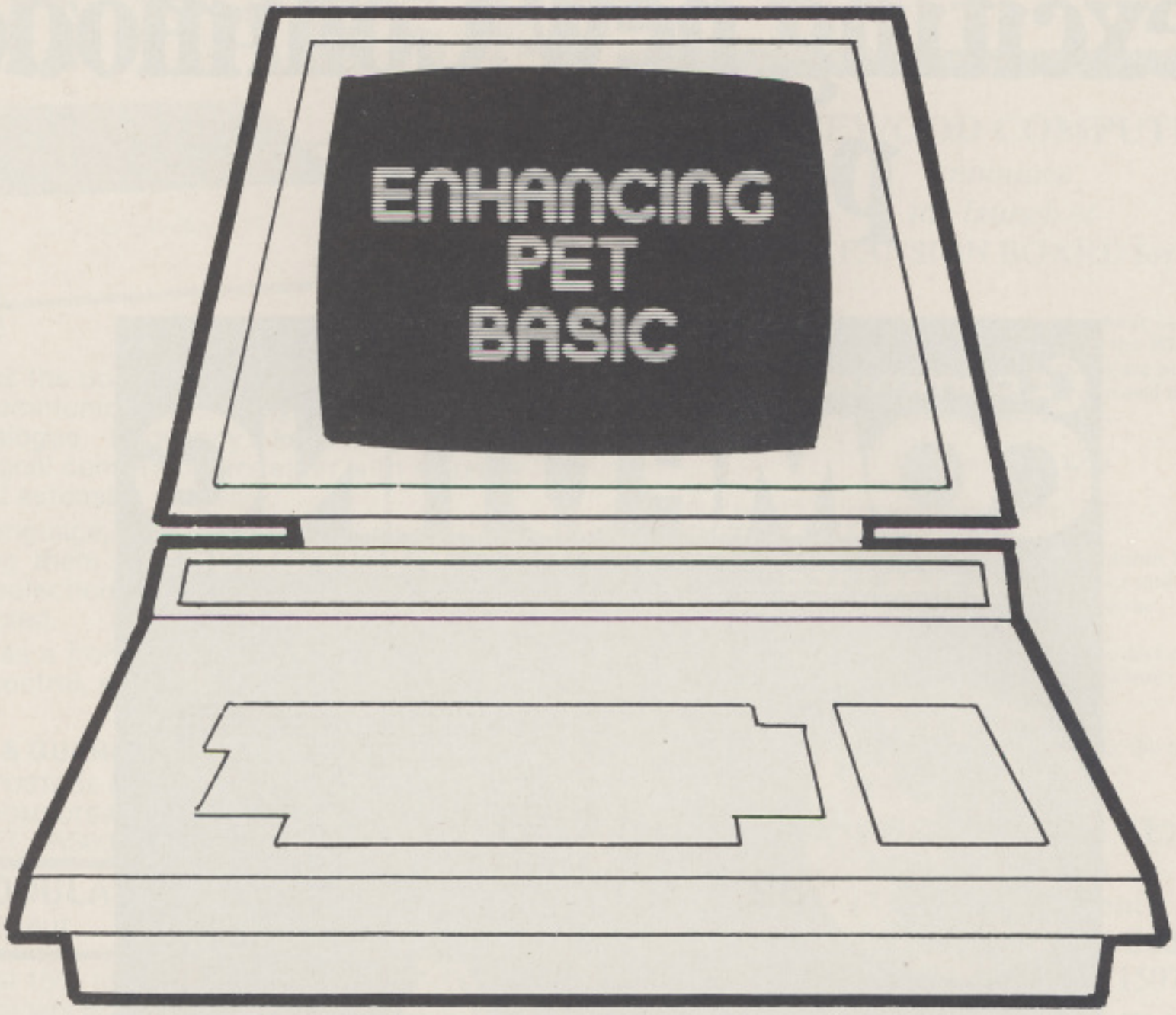

Intent on their course of completely re-designing the Commodore PET, **Dave Barrett** and **Dave Wardill** show this month that it is possible to squeeze a whole lot more space out of the ROMs and use it for your own devious purposes!

Lots of PET users have a program they use all the time. 3040 disk owners will have a copy of UNIVERSAL WEDGE or DOS at the beginning of every disk, ready to load up at the start of every session. Machine Code freaks will have EXTRAMON to hand before they start their exploration of the unknown.

However, they all met one snag. All these programs have to be loaded at the start of the day. They all take up memory, and pointers have to be set to protect them before any other activity can begin. (Some versions do this automatically, others don't.)

Could be better

Somehow, all this is alien to the philosophgy of the PET. The PET was designed as a very user-friendly machine, ready to go as soon as you turned it on. This was one of its most attractive features for use in schools, for instance. You didn't have to boot up, load CP/M, BASIC and all the rest – it was ready as soon as you were.

As the PET has evolved, new programs have become desirable for the enthusiast, but they are not available in ROM. Until now, that is. With little effort, you can fit your favourite routine in ROM, in a place where it doesn't take up any of the precious sockets which you have already filled with TOOLKITS, WORDPRO, VISICALC, SUPERCHIP, COMMANDO-O, PASCAL, and a dozen security chips.

Virgin territory

The location we would suggest for your use is the 'E' socket. Yes, we know that there is one of Commodore's BASIC ROM chips there already, and we aren't suggesting that you throw that away.

On the other hand, did you know that only half of it is used? The first 2048 bytes are used normally, like the other ROMs. The next 128 bytes are wired off, and their addresses are used to divert signals elsewhere. This is shown in Figure 1.

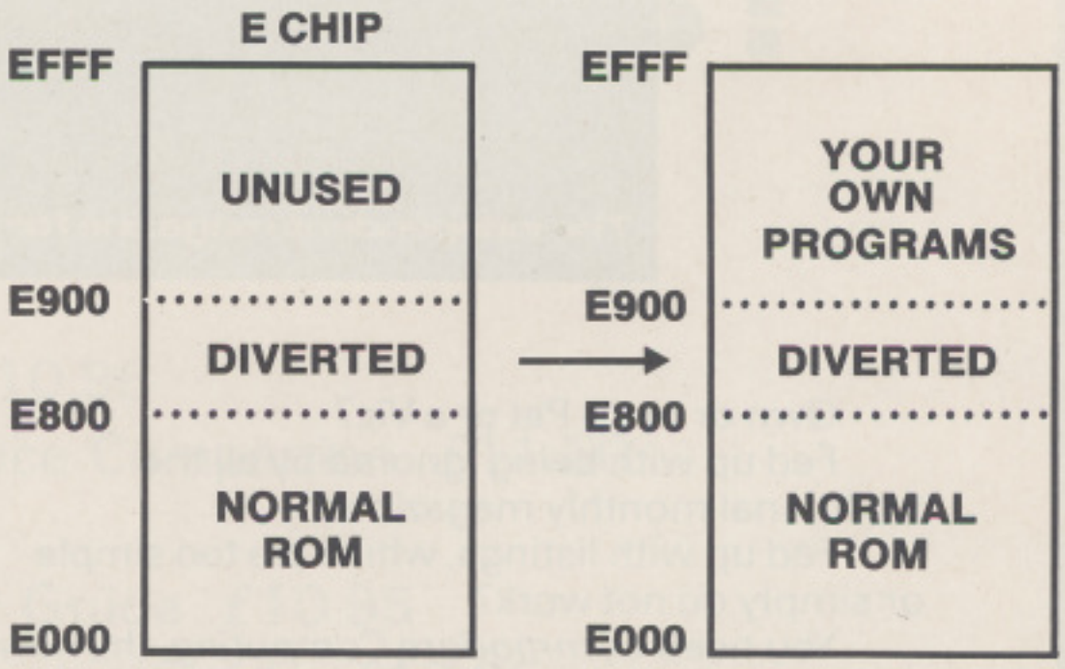

Figure 1

For example, the memory used in the command POKE 59468,14 lies in this part of the ROM. The poke is diverted to the PIA 2, which controls input and output. So, when you change from graphics to lower case and back again, you are not actually POKEing a ROM, although it would appear that you are, from the address of the memory that you use.

The remaining 1920 bytes in the 'E' chip are unused. What an opportunity this gives, to store our favourite

program there, readily available when we switch on? If only we could!

Technical details

The diagram (Fig. 2) shows how it is done. First an EPROM must be burned. In the first part, put the standard program which was in the first part of your standard 'E' chip. In the last 1920 bytes, put your favourite program (we chose EXTRAMON, but DOS could go there instead.)

Next, an arrangement must be made so that the signals intended for elsewhere continue to be diverted. The select signal from pin 22 of the 6520 chip, which is activated when page 8 of any chip is being addressed, is examined. If that signal is being received, then the 'E' chip is bypassed. If any other signal is received, the chip is used as normal. This lets us access all the rest of the chip.

This is done by passing the signals from pin 22 of the 6520, and the incoming signal on pin 20 of the 'E' chip, through a gate on a logic chip. The schematic layout is shown in Fig. 2.

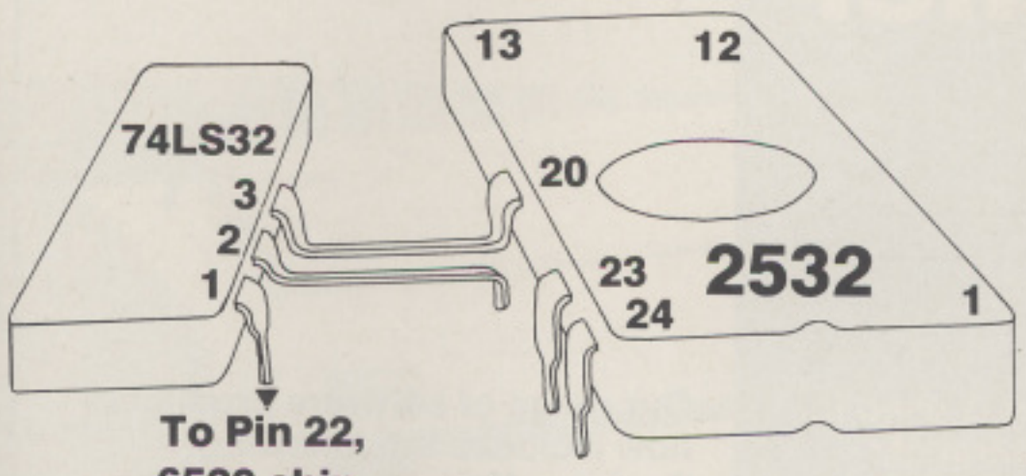

Figure 2

With this arrangement, the remainder of the 'E' chip can be addressed as ROM once again, and we can use the valuable space for our own programs.

Non-technical

What if you don't want to go rummaging inside your PET with a soldering iron? Lots of people might be interested in this idea, but lack the expertise or the confidence to have a go. In that case, it is possible to buy the finished chips made up on a board, ready to install.

All you have to do is take out your 'E' chip and plug in the board in its place. A wire with a little hook connector is fastened to one of the pins of the 6520 chip, and the PET is again ready for use.

There are a number of companies who have taken up this idea, and it is possible to obtain the finished product from a number of competent suppliers. If you can't find one among the advertisers in *MicroComputer Printout* this month, we can suggest firms you could try.

New friends

Since we started this series three months ago, we have had about 150 calls from *MicroComputer Printout* readers. The enquirers have ranged from complete novices to considerable experts, and we have found every call of interest. People have rung with problems, with ideas to swap, and with ideas for our BASIC ROMs. Not only have we been able to help a lot of people, but we have gained a lot ourselves. So, keep the calls coming, please. You can reach us on Durham 711380.

Next month, we are going to give you the low-down on our SEEK routine. This will search an array to see whether a string lies anywhere in any of the elements. When we tested it, we asked it to find all the occurrences of 'arret' in an array of 1000 names. It found 5 occurrences, hidden in names such as Barrett or Garrett, and reported where they could be found, in less than a second. See you next month.

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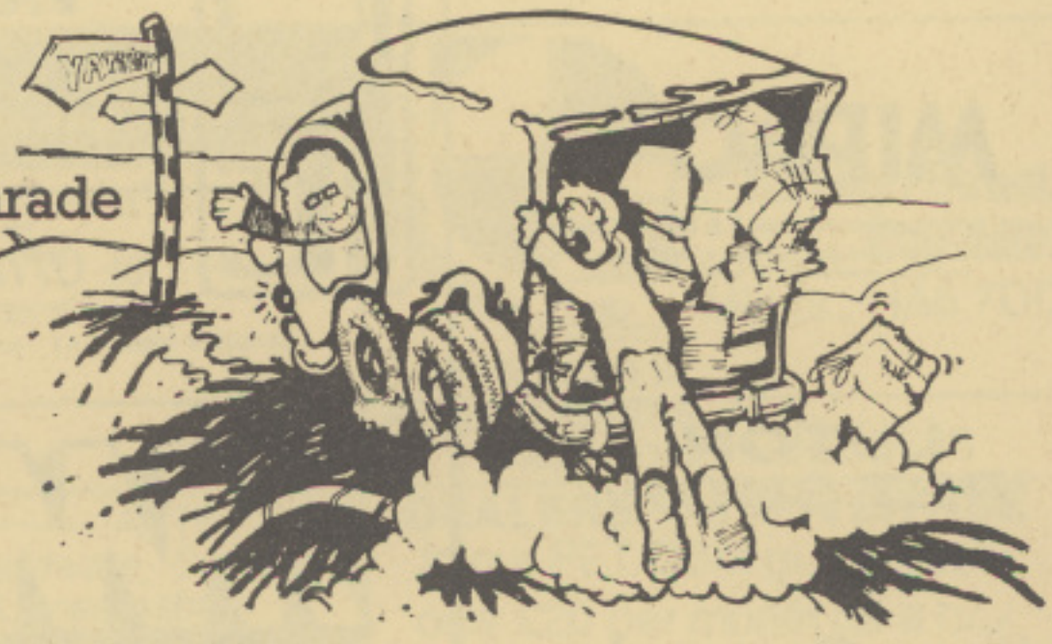

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Rex Malik's JOKE BOOK

The biblical tags I ran in a recent issue made the Editor generally fall about. As it takes a lot to make this particular Editor fall about, here are some more.

Program bugs: When I would do good, evil is present with me. *Romans 7:21.*
Data validation: And there shall in no wise enter into any thing that defileth. *Revelation 21:27.*
Error correction: Fret not thyself because of evil doers. *Psalms 37:1.*
Resource allocator: For I am a man under authority and I say to this man, so, and he soeth; and to another, come, and he cometh; do this, and he doeth it. *St. Matthew 8:9.*
And finally for all those crawlers seeking promotion, the section managers at their monthly meeting with the DP Manager: They said unto him, grant unto us that we may sit, one on thy right hand and the other on thy left hand, in thy glory.
St. Mark 10:37.

And if he still wants some more, I have a good stock of others tucked away.

****

Have you ever come across Stan Bootle's Devil's DP Dictionary? Inspired by it, Computer Weekly asked readers for their own definitions of common computing terms. The response was large, among which were to be found the following.

ALU (n). Arthritic Logic Unit. Sometimes CPU, a random number generator.

Applications packages (n). Programs written by a firm and designed to be implemented in a number of sites to cause bigger and more widespread disasters than the simpler "one-off" programs.

Blinking cursor (n). (deriv. of verb to curse) A faint trace on a VDU screen used to test the eyesight and reflexes of the operator. Designed to provde a hypnotic point of interest to the casual visitor while waiting for the system to recover from a previous crash.

Jargon (n). What the managers talk when they don't know what is going on.

Manual (n). A six inch thick book without an index.

Microprocessor technology (n). An approach to hardware design which enables one engineer to be replaced by a full scale computer development team.

This generation of words and their meanings seems to be an international pastime. Over in the States there has even been generated the "Artificial Intelligence (AI) Jargon File." These are words actually in use among the hackers in the community.

Software rot. Hypothetical disease the existence of which has been deduced from the observation that unused programs or features will stop working after sufficient time has passed. Also known as "bit decay".

Feature. 1. A surprising property of a program. "That's not a bug, that'a a feature!" 2. A well known and beloved property. An approximately correct spectrum from worst to best: Crash, stoppage, bug, screw, loss, misfeature, crock, kluge, hack, win, feature, perfection (this last is never actually attained.)

Misfeature. A feature which eventually screws someone; not the same as a bug because fixing it involves a gross philosophical change to the structure of the system. "Well, yeah, it's kind of a misfeature that file names are limited to six characters, but we're stuck with it for now."

****

Seeing as this seems to be reality in computing month, finally a true story.

The Vicar, faced with a problem in complexity, decided that he should use the technology of the day, and called on the local computer centre. The problem was that his grave diggers were reporting that they could not find space for fresh graves in his graveyard, though back of envelope calculations indicated that there should be more than enough room.

The local computer centre was much taken with this request and talent was brough to bear and a program written. Data was punched up including the dimensions of the standard coffin, and the program was run.

Much to everyone's astonishment, the system reported that the cemetery was only about one third full. The program was checked, and rechecked. It took a great deal of work to establish that the system was proposing to stack the coffins, not horizontally, but vertically.

"It's clear from reading your report, Anderson, that you have emerged unscathed from the information explosion."

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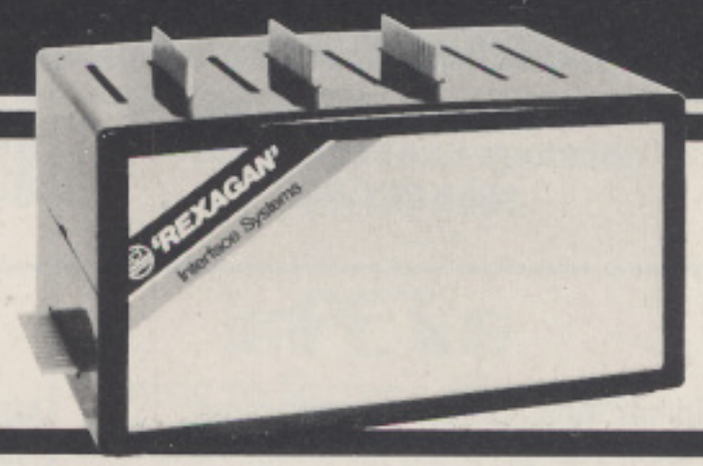

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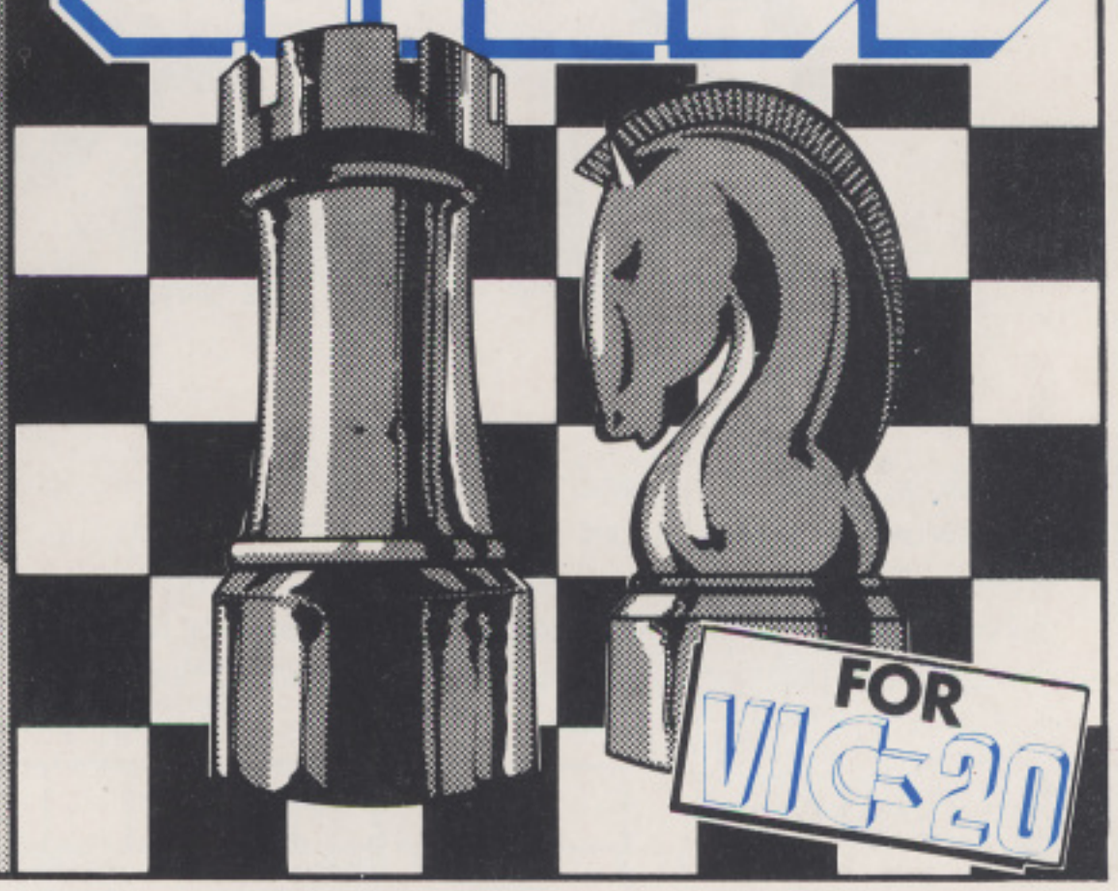

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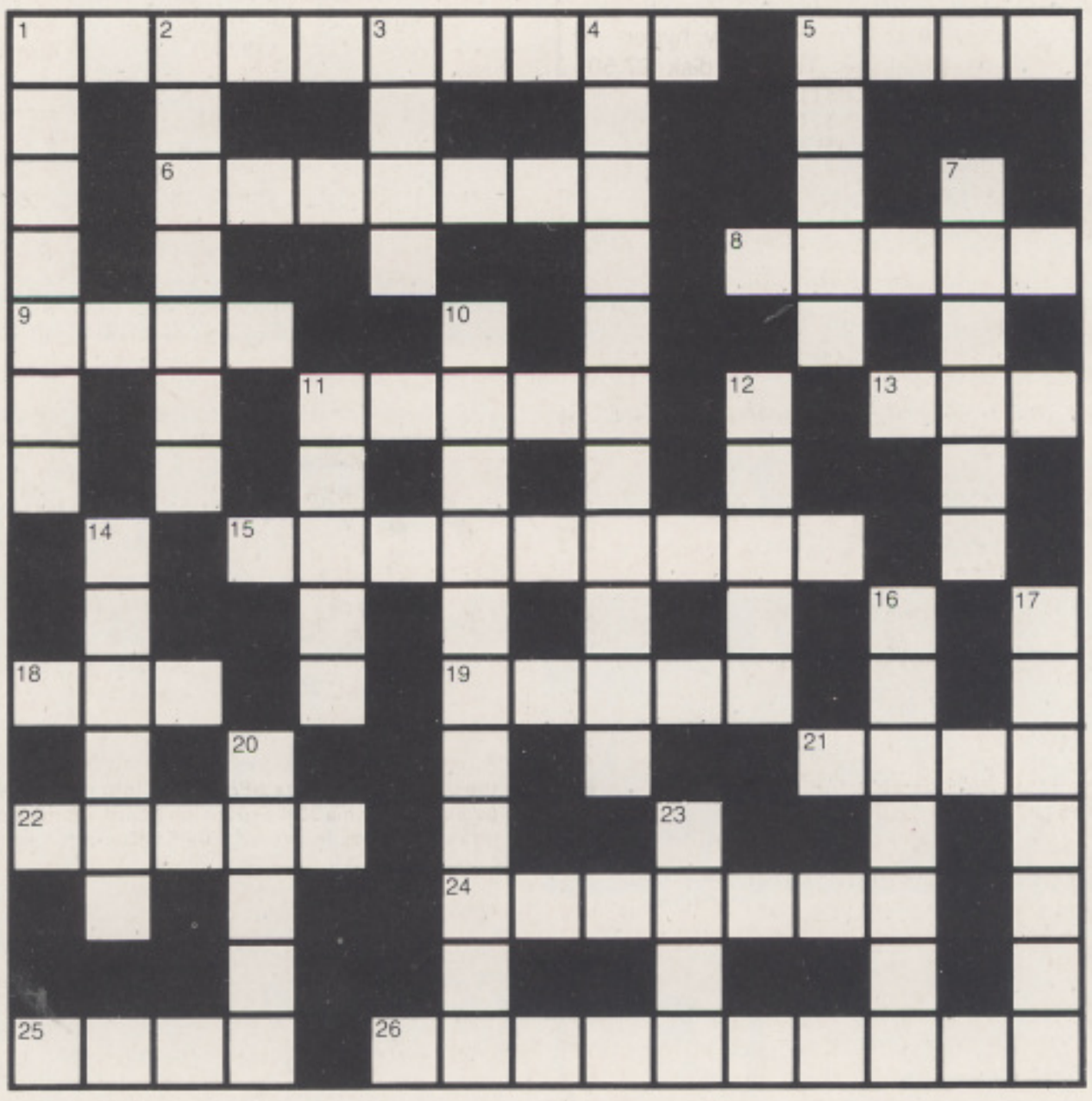
Computer Crossword

A special treat for literary contortionists – a cryptic crossword in which *most* of the answers relate to the world of computers! Use your skill and judgement to solves the clues below. Alternatively, cheat by finding the answers printed upside-down elsewhere in this mag.

Use of computers, and in particular, programs like Bob Chappell's Anagram Cracker (see May issue) is *not* considered unsporting! The crossword has been compiled by **David Pinless**. We welcome feedback from reders on the suitability/difficulty of the clues.



CLUES ACROSS

1. Mr. Micro's bit on the side? (10)
5. Tie around ten and quit the program. (4)
6. Made nut wild! (7)
8. Peom in two thousand for data transmission. (5)
9. Tape head to gain one of two. (4)
11. Relies on memory. (5)
13. Sometimes mortal way in. (3)
15. Slide note possible changes when programming. (9)
18. Consumed a turkey escalope initially. (3)
19. Layer amendment to circuit. (5)
21. Objective around before five hundred come in between. (4)
22. Well organised set of variables. (5)
24. Coin sir, for a teething problem. (7)
25. Not always hard storage medium. (4)
26. Matches between people. (10)

CLUES DOWN

1. Hardware able to do a reprint. (7)
2. Usual part of a program. (7)
3. But it's not the kind of sink in which to wash a micro. (4)
4. Half adders and lies Brie permit easy location. (11)
5. Memory of sheep romance. (5)
7. Style might be computer aided. (7)
10. Heartless integer ration requires compatibility. (11)
11. Interrupt for coffee. (5)
12. Any refusal about to irritate. (5)
14. Comeback after a 2. (6)
16. Type of character not associated with strings. (7)
17. After getting in, makes an impression when starting a new paragraph. (7)
20. Although elementary, it's not used just by beginners. (5)
23. Not the one to obey the truth table. (4)

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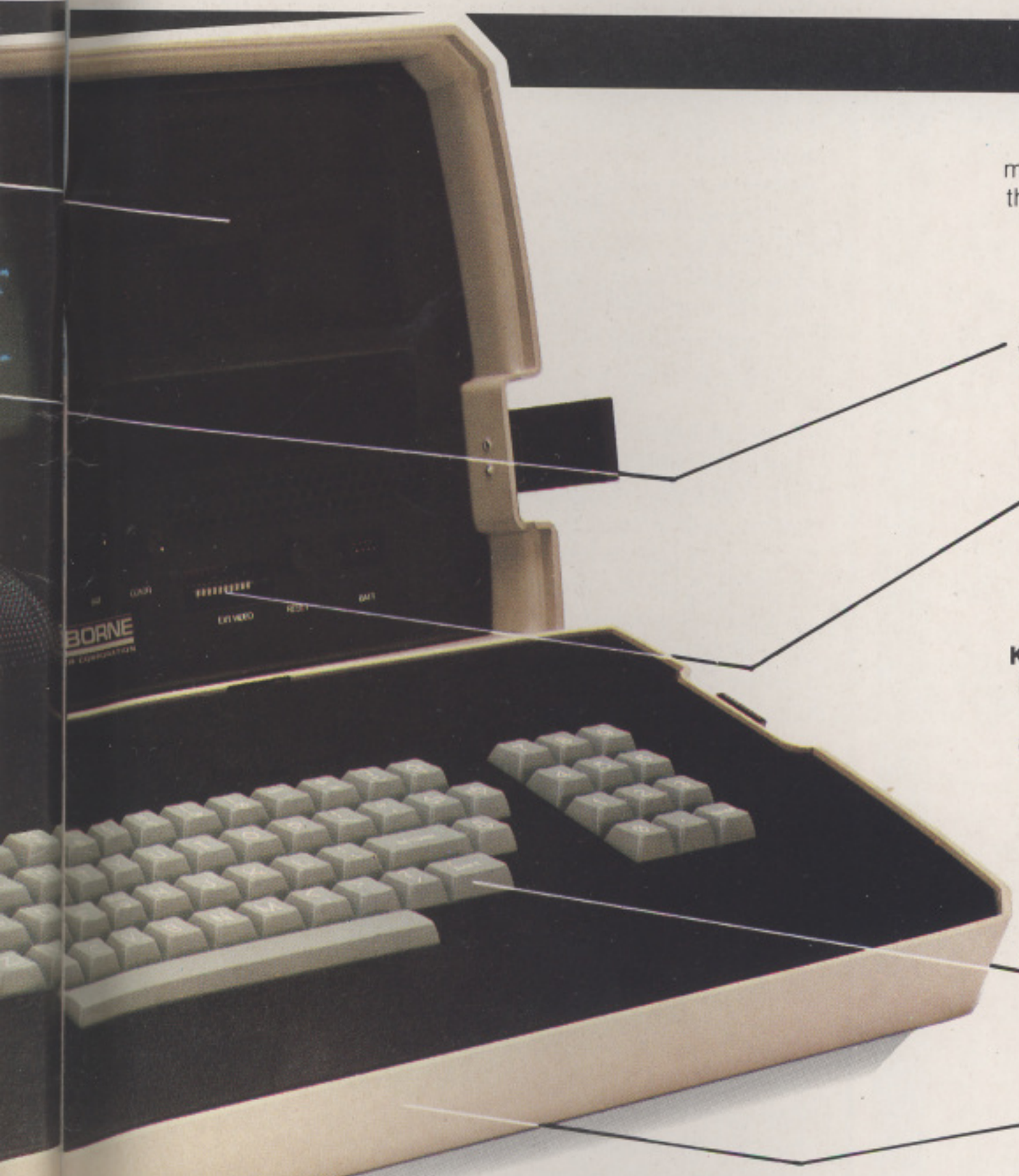

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INSIDE TRADER

The editorship of *Educational Computing* is widely respected as one of the very pinnacles of computer journalism. Amongst the qualifications required are an incisive mind, outstanding technical knowledge, extensive journalistic experience, and a penetrating insight into the academic mind. (A good imagination is also considered helpful.) Belated congratulations then to the lovely Josie Adams upon her appointment to this august position. Ms. Adams was previously employed as an au pair chez to Byte Shop founder, Mr. Paul 'Naughty' Terrell.

What could Apple be doing buying Sinclair Spectrums when they have a whole warehouse of unsold computers of their own? According to our local arsonist you need something really hot to get a good fire going...

Atari, authors of *Pacman*, a computer game wherein small round men gobble their way around the screen, have instituted legal proceedings to restrain Commodore from selling *Jelly Monsters*, a computer game wherein small round men gobble their way round the screen. After initially resisting the action on the dubious grounds of monopolistic practices, Commodore have generously offered to withdraw *Jelly Monsters*. Commodore are shortly expected to release *Cosmic Crunchers*, a computer game wherein small round men ...

PC stands for Personal Computer, as in I.B.M. P.C., and this year the Jolly Grey Giant will spend an unprecendented amount establishing it as a brand name. I hope no-one is unsporting enough to remind I.B.M.'s arch-enemies, DEC, that it is they who own the registered name P.C.

Heads have rolled at the BBC following an unkind practical joke perpetrated by our revered Editor upon the producers of the *Tuesday Call* program. Who, the Radio 4 men had asked, could he nominate to answer live listeners questions upon matters computational? Only the most fluent, the most distinguished, the most *sober* experts would do. It seems that the combined effect upon the radio audience of Desperate Dave Tebbutt and Martin 'Legless' Banks was *not* what was required.

Hot competition for this year's Frank Spencer Award for Unusual Marketing Strategies. Widely tipped to win are Acorn and their innovative delivery policy on the BBC Micro. However, I fancy Texas Instruments with their challenging practice of increasing production of TI99/4As every time sales dip.

To San Francisco for brunch with my old friend Steve Wozniak, Apple founder turned rock concert promoter. The erstwhile garagiste is playing with a tiny new 68000-based portable. 'Oops, you're not meant to have seen our project Macintosh,' he burbles. 'Promise not to tell?'. I promise.

A series of distressing incidents marred Uncle Clive's triumphal tour of the Land of the Rising Sun. Every time our micro maestro gave his speech about Sinclair BASIC becoming the world standard, some innocent Japanese would stand up and say "Ah so! Then why honolerable BBC Micro not use it, Sinclair-san?" Clive is still trying to work out if those naughty Nips could have been taking the Michael.

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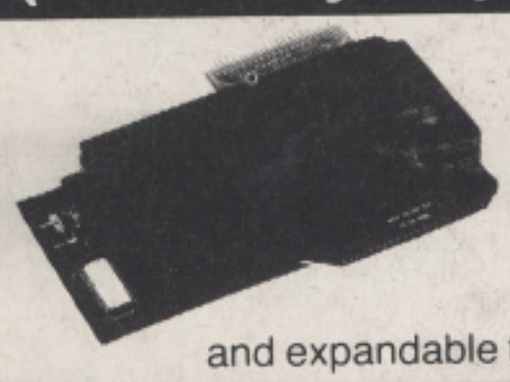

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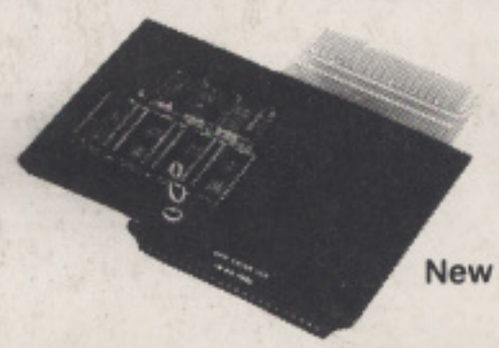

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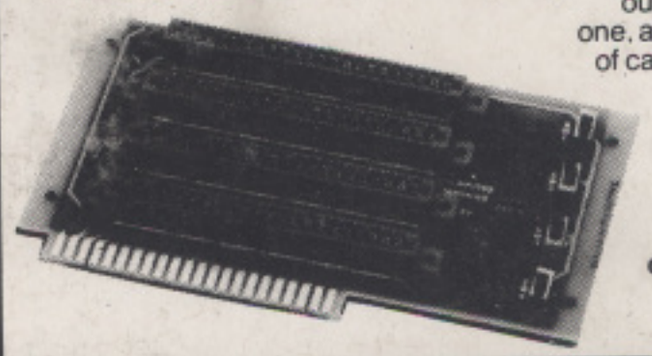

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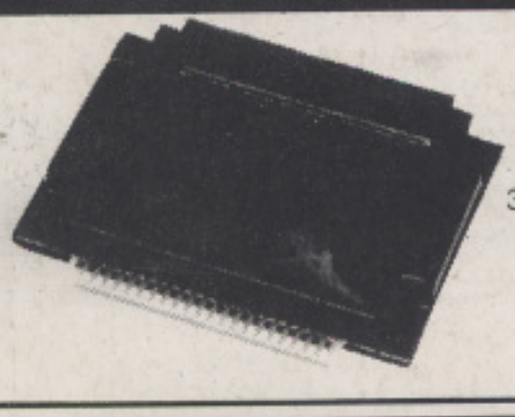

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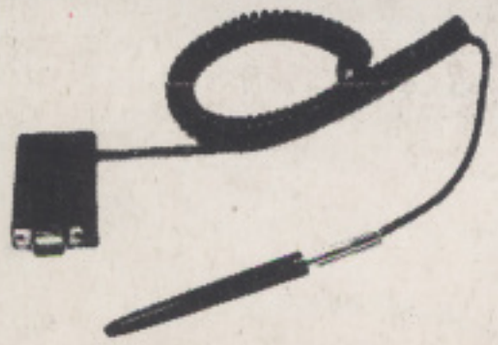

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